Technical and Vocational Education and Training:
Issues, Concerns and Prospects 23

Martin Mulder *Editor*

Competence-based Vocational and Professional Education

Bridging the Worlds of Work and Education

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Technical and Vocational Education and Training: Issues, Concerns and Prospects

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Foreword

This comprehensive volume, entitled *Competence-based Vocational and Professional Education: Bridging the Worlds of Work and Education*, comes at a timely moment as the discourse on what education and training should look like in the post-2015 era reached its peak with the adoption of the 'Education 2030 Framework for Action' of the World Education Forum.

'Education 2030' builds on the achievements of 'Education for All' in promoting access to education at the primary level and extends this to promoting inclusiveness, equity, quality and lifelong learning for all. Education 2030 aims to transform lives through education, taking cognizance of the vital role of education in driving development and in achieving the United Nations' Sustainable Development Goals, which purposefully include technical, vocational and tertiary education, and technical and vocational skills for employment and entrepreneurship.

Quality, equal access, mobility and lifelong learning underpin the new global educational vision. This implies the need for ensuring that education and training are systematically planned, monitored and measured, as well as aligned to the intrinsic purpose it serves. Competence-based vocational and professional education and training (CBE) highlights the core principle of aligning competence needs with the societal standards, norms or expectations regarding task performance. This view on the future developments of vocational and professional education necessitates a holistic approach to empower learners with adequate conceptual knowledge and demonstrated capacities to perform tasks, which enables them to move up the ladder of success of their career choice and to fulfil their personal development goals.

This well-composed volume with highly relevant parts and chapters intends to sharpen the understanding of the nature, approaches and innovations in this area. As the volume initiates a discourse on comparative approaches in CBE, it opens up an insightful window to the world's successful strategies and frameworks of competence-based education and training.

In line with the Education 2030 agenda and Sustainable Development Goals, expanding competence domains needed for the world of work of today and tomorrow

and approaches to monitor and measure new competence domains are very well addressed in this volume.

Because of this, it serves as a very helpful resource for education and training practitioners, providers, policymakers and researchers to bring them up to speed on systematic approaches for developing society-relevant competence-based vocational and professional education and training. This makes this volume an important contribution to the knowledge base which is available to take the new education agenda effectively forward.

UNESCO-UNEVOC Shyamal Majumdar
Bonn, Germany

Foreword

I am very pleased to be able to introduce this important volume on a central topic in vocational and professional education. As Professor Mulder notes in his Introduction, competence-based education and training (CBET) has had a long history, starting with competence-based teacher education in the 1970s. Since then, the influence of competence approaches to vocational and professional education more generally has expanded across the globe, as a quick glance at the contents of this volume will rapidly indicate.

This rapid expansion has itself brought problems in its train, problems that were implicit at the outset of the movement to embed the concept of competence at the heart of vocational and professional education. The first of these problems was the inadequate conceptualisation of competence, involving as it did an overreliance on the concept of *skill*, itself a simplification of the complexities of professional know-how. In Britain, for example, the term 'competence' is often used both to indicate a threshold level of performance of a skill and to indicate a job-relevant bundle of skills. Transversal abilities such as the ability to plan and communicate tend to be neglected in competence frameworks or, where they are included, tend to be reduced to associated skills, such as 'planning skills', 'communication skills' and so on. The confusion is completed through the confounding of *transversal abilities* with *transferable skills* such as can be found in the attempts at comprehensive classifications of know-how in the approaches of ESCO in the EU and O-Net in North America.

Second, the term 'competence', as it was adopted in the non-Anglophone world, also adapted itself to indigenous educational traditions, thus altering its meaning to such an extent that it is difficult to talk intelligibly of a unified concept of competence across the globe. Instead, we need to take a close look at the actual use of 'competence' and cognate terms in different jurisdictions and carefully try to understand how the concept is being employed in those contexts. If we fail to do so, then we run the risk of misunderstanding what our colleagues in different jurisdictions actually mean when they talk of professional competence.

The time is more than ripe, therefore, for a volume that tackles in a comprehensive way the complexities and puzzles that competence-based vocational and professional education has generated. No doubt Professor Mulder's collection will

itself become the subject of lively debate in the years to come. This will be all to the good as it is most important that both the conceptual and the comparative dimensions of the study of competence are given their full due. The four sections into which this volume is organised deal with all these issues and more, including the critical issue of the implementation of competence-based approaches, competence-based approaches and different education systems and last, but not least, competence-based vocational and professional education and the labour market.

It is to be hoped and can be confidently expected that this volume will prove to be an invaluable source for practitioners of, researchers in and students of vocational and professional education for many years to come.

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Christopher Winch

Preface

Many countries, national and international institutions, schools and colleges, professional associations, chambers of commerce, companies and consultancy organisations were, and still are, struggling in getting the implementation of competence-based education, competence modelling, competence-based professional development and competence assessment right, in the midst of heated debates about competence in theory, research and practice.

Although competence appeared to be a fuzzy concept, there are many practices attached to it. Key features, which are widely addressed in this volume, are the alignment of education and work, the assessment of prior learning, demand-driven educational planning, authentic learning, formative assessment, and new competence domains. All these practices vary country by country, institution by institution and program by program. That makes the world of competence-based vocational and professional education intriguing and fascinating.

Competence appeared to be a very resilient concept. In the 1970s, the competence-based teacher education (CBTE) movement started. CBTE was heavily criticised by humanistic scholars, who, in turn, advocated humanistic-based teacher education (HBTE). Being educated as a school teacher in the 1970s and having had 5 years of experience in teaching in and managing of an elementary school, I had the impression that a mix between these approaches would be fruitful for the development of teacher education. Attention to the democratic ideal of education, personal professional development and identity formation, mixed with attention to actual teaching behaviour, could in my opinion be a productive blend of ideology and practice. I saw with my own eyes that theory and practice needed to be in balance. Too much theory or ideology resulted in poor teaching, whereas too much practice resulted in shallow reflection on professional action.

There is a massive amount of publications on competence; this reflects that competence-based education is a global innovation, especially in vocational, higher and corporate education. Currently we can really speak about the existence of competence theory, competence research and competence practice. The literature on competence has grown so big that it takes a lot to get a good overview. This volume may help to get that overview and to further appreciate its diversity.

The preparation of this volume started in the Spring of 2013, during my stay at the Toulouse Business School in France. Together with Jonathan Winterton, an outline of the volume was drafted, which was submitted to publisher Bernadette Ohmer of Springer and series editor Professor Rupert Maclean, who was at the Hong Kong Institute of Education at that time. The outline and tentative table of content were discussed with the series editor in March 2014, and various suggestions were given for more authors and chapters. After this meeting, candidate authors were invited, and we received a very good response. Only a few did not have the time to contribute to the volume because of research assessments or other important duties. During the process of communication with the authors, we detected various gaps in the intended content of the volume, and we added chapter titles and invited more authors. We were very fortunate that the publisher did not have any objections against this. On the contrary, we felt encouraged to compose a volume which would cover the field of competence-based vocational and professional education as widely as possible.

Authors were given a fair amount of time to write their draft manuscripts, and when these came in, a long process of reviewing started, making revisions and doing second reviews and other revisions.

As time passed by, Jonathan Winterton made a significant career move by accepting the position as dean of the faculty of business and humanities at Curtin Business School of Sarawak in Malaysia. Because of this life-changing event, he had to disengage from the book project. I would like to express my sincere gratitude for the discussions we had regarding the outline of the volume, for the reviewing and editing we did together and for co-writing Chap. 1. I greatly enjoyed the time spent together in Toulouse and Amsterdam while working on the volume. It was also a privilege to have had the opportunity to speak about the book project at the International Conference 'Skills for the future: Training, employment, occupations employability in turbulent times', at the Toulouse Business School in September 2014.

A book project of this size takes time. From the start of the project in 2013, the year 2016 was anticipated as the publication year, which is achieved with the collective effort of all involved authors and colleagues from Springer.

This volume could not have been realised without the support of many people. I have already mentioned Jonathan Winterton. Had I known that I would have to complete this project alone, I might not have had the courage to start it in the first place. It is because of our initial cooperation that the book project took off. Thanks.

Many thanks also go to Bernadette Ohmer, who was the initial publisher of the volume. She was very responsive and positive about the idea of the volume. When she took notice of the ever-growing book project, it seemed as if her enthusiasm further increased with it. There were hardly any objections against our plans, even when they were adjusted over time.

Rupert Maclean, as said, series editor of the volume, has been very positive and encouraging, right from the beginning of the book project. He suggested a number of authors of which some have indeed contributed to the volume. His warm feedback on new ideas and the quality of the chapters and his patience to see the volume grow to full maturity are greatly appreciated.

Without the commitment and achievements of the many chapter authors of this volume, it would not have been realised. To all the authors, many thanks for your contributions.

Lawrence Liu, Education and Language editor at Springer, the final publisher of this volume, working with you was a pleasure. I am deeply impressed by the rigour of the publishing process of Springer. It greatly added to the quality and appearance of the volume.

My colleagues in ECS, the Education and Competence Studies Group, at one of the world's leading universities in the field of life and social sciences, Wageningen University, also deserve a big compliment. We have had numerous debates about competence theories, definitions, research and measurement and have published a large number of professional and scientific articles together, based on our research. The many interactions during the last 18 years we have been working together greatly contributed to deepening and widening my thinking on competence.

Colleagues in the vocational education and training, professional education, higher education, human resource development and human resource management communities have also contributed a lot to the knowledge about and insight in competence theory and research. During the many conferences at which research papers on competence development were presented and discussed, various, and sometimes fierce, debates were held about the competence construct, competence research and competence practice, which further sharpened the insights in this field of study. Thanks for these interactions.

Finally, also on behalf of the chapter authors, I hope this volume will help in further understanding the complex field of competence-based vocational and professional education and, ultimately, help to effectively bridge the worlds of work and education.

Borne, The Netherlands Martin Mulder
May 2016

Series Editor Introduction

Work is a major feature of most people's lives. Not only does it provide them with the means to meet basic needs, such as food, clothing and shelter, but also the type of work undertaken by individuals and groups has a major impact on their self-identity, social status and standard of living. Technical and vocational education and training (TVET) is concerned with 'applied learning', with the acquisition of knowledge and skills for the world of work to increase opportunities for productive work, sustainable livelihoods, personal empowerment and socio-economic development.

This Springer book series on TVET seeks to provide comprehensive information about many cutting-edge aspects of TVET. The series showcases best and innovative approaches to skills development for employability and seeks to create an effective bridge between research, policy and practice. It is an ongoing project which commenced in 2005. Since then, this Springer book series provides a comprehensive picture of current issues, concerns and prospects in TVET worldwide.

This book, which is edited by the eminent TVET researcher, writer and academic Professor Martin Mulder, examines an important, cutting-edge topic, that of competence-based vocational and professional education, and most effective ways of bridging the world of work and education. Applied learning, to be effective, needs to actually be 'applied', not just theoretical in orientation, and so it must be competence- or performance-based. This book is a substantial contribution to this field, the aim being to examine existing worldwide experience concerning how to best and most effectively bridge the world of work and that of education. This is a sizeable book of 50 chapters which examine important matters such as: approaches to the development of conceptual foundations; worldwide trends and innovative approaches to competence-based education in Europe, North America, Asia, Australia and Africa; competence and key aspects of education systems; recognition, assessment, quality management and effectiveness; transversal competence domains; and lessons learned from previous experience and the best way to move ahead as this specifically relates to competence-based teaching and learning in technical and vocational education and training.

This is an important, cutting-edge volume on a topic that is of great importance to researchers, policymakers and practitioners throughout the world. I have no doubt that this book will be widely read and that it will have an important impact on policy and practice in this area.

QAPCO Professional Chair in Vocational Studies Rupert Maclean
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College of the North Atlantic-Qatar
April 2016

Contents

Contributors

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Frank Achtenhagen is professor and emeritus at the Georg-August-Universität, Göttingen, Germany, where he was director of the Institute for Human Resource Education and Management during a period of 36 years. He got his doctorate from the Free University of Berlin and received honorary doctorates from the Universities of St. Gallen (Switzerland) and Helsinki (Finland). He is member of the Finnish Academy of Sciences and Letters. His work comprises the whole field of VET. He is engaged in large-scale assessment of VET.

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Len Cairns is associate professor (adjunct) and has been a leading teacher educator and researcher in VET and workplace learning for the past four decades. Prior to his retirement from full time work at Monash University, he was the associate dean (engagement and international) in the Faculty of Education for over a decade. Len has written extensively on competence-based education and training and the more recent extension into capability.

Rhona B. Caoli-Rodriguez has a master's degree in international education from the University of Sussex and has worked in various projects with UNESCO, Oxfam, SEAMEO Innotech and the Asian Development Bank, amongst others. She has been involved in various publications related to education.

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Hans Corten is a senior lecturer at Vilentum University of Applied Sciences and holds a PhD from Maastricht University. His PhD study was about competence development and labour market benefits. Currently he also works as a consultant in innovative teaching skills and curriculum development, nationally and internationally. He developed competence-based curricula in Ghana, Benin, Indonesia and Mozambique at bachelor and master levels.

Christopher Day has led and continues to lead national, European and international research and development projects in the areas of teachers' work and lives

and school leadership worldwide. He is editor in chief of *Teachers and Teaching: Theory and Practice* and a member of the Editorial Board of the *British Educational Research Journal*.

Cees de Jong worked in 2001–2014 as managing consultant at CPS educational development and advice in Amersfoort. Along with a large number of schools for pre-vocational and secondary vocational education, he developed a test of useful practical tools for measuring competence growth of students. Currently Cees de Jong is principal at two schools for pre-vocational education in the province of South-Holland, Melanchthon Business School in Bleiswijk and Melanchthon Berkroden in Berkel and Rodenrijs.

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Chapter 1
Introduction

Martin Mulder and Jonathan Winterton

1.1 Introduction

When we rise in the morning for a new day, we expect water for a shower, fruit, bread and coffee for breakfast, transportation to get to work and a workplace to do our job. When we travel abroad, we expect a safe flight and hospitality. When we get sick, we expect effective medical treatment. In all these processes, billions of people deliver goods and services, and we expect they are competent in what they are doing. But how often do we become frustrated because what we get in terms of goods and services is not what we expected as a result of gross incompetence.

For example, a car owner had problems with the LPG installation in the second-hand vehicle he had recently bought. This installation was built in by the garage where the car was bought. But after a while the car did not run smoothly, and the owner returned to the mechanic who had built in the LPG installation. The story was that the gas pump was broken and that it needed to be replaced. This was done, but when the car owner went on holiday abroad, the problem came back and the car could not use all of its engine power, which caused serious danger when driving uphill. So an LPG installation expert in the region was consulted for a check. It appeared that the gas pump seemed to be broken (again) and that it should be (again) replaced. However, this car mechanic found out that the problem was caused by an improper installation of the gas pumps. According to him some car mechanics tend to forget to remove a special small plastic cap during installation. The explanation of this error was that the instructions for this detail in the manual were printed small

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and were a bit unclear. But the error causes damage to the gas pump. After this repair the problem of engine power loss never occurred again. To cut a long story short, a small bit of incompetence created considerable problems. Issues like this happen on a daily basis. Luckily, most of them are just annoying but not harmful of fatal. But what if this happens in a nuclear power plant, pharmacy, surgery or even education? Look at the mistakes made by medical professionals. Think of the teachers who are not able to maintain their position in classrooms and who instead of nurturing relationships with their pupils and students devastate them. It is obvious: competence is badly needed. And when we experience competent behaviour in problem situations, we are immediately relieved.

1.2 The Importance of Competence

Not many people will argue the necessity of competence in professional decision-making and behaviour. Some may believe, however, that the competence movement is somewhat outdated and overruled by current practices of online learning and other innovations. These people most likely think of the first wave of competence policies and practices, which some have experienced in their own education. The current status of educational innovation is all about learning analytics, Massive Open Online Courses (MOOCs) and brain research. Or? Well, as a surprise, current innovations in education and the competence movement were linked to each other in a 2014 issue of a leading business science journal. It says 'The Real Revolution in Online Education Isn't MOOCs.' '… there is a new wave of online competency–based learning providers that has absolutely nothing to do with offering free, massive, or open courses. In fact, they're not even building courses per se, but creating a whole new architecture of learning that has serious implications for businesses and organizations around the world. It's called online competency–based education, and it's going to revolutionize the workforce' (Michelle Weise in the 17 October 2014 issue of *Harvard Business Review*). Education has seen many fads and fashions, and MOOCs may be one of them, but competence-based education certainly is not. Why is it that this educational philosophy is so persistent that it has now lasted for over 50 years?

The reason for that may be simple: as said, society needs a competent workforce. Fifteen years ago, Raven and Stephenson (2001) stated that the world was far away from a competent society. Since then, much has been realized, but there remains a lot to be done to achieve a competent society. Education has often been accused of delivering graduates who are not really prepared for their jobs. Massive corporate training and development provision has to prepare the workforce for their future jobs, improve their current performance and increase their employability. Graduates may be knowledgeable and may have had broad and deep inductions into a given field, but their capability of using that knowledge in specific working situations may be limited and may not meet the requirements of the stakeholders involved: employers, managers, supervisors, subordinates, colleagues, clients and the public. Many of the workers in elderly homes, hospitals, schools and banks are seen as utterly

incompetent. If the word incompetence is googled, nearly ten million of hits are shown, including endless number of cases of incompetent work.

Worldwide, competence-based education has gained much interest as an innovation to prepare more effectively for superior performance, to overcome the barriers between the world of education and the world of work and to align educational programmes in vocational, professional and higher education to labour market needs and developments in society. This educational philosophy has challenged education to step out of its comfort zone, away from memorising textbooks and doing reproductive tests, and to think outside in. What does the changing society need from graduates, who will get or create jobs that may not yet exist? What education does the current generation of kids who enter the elementary schools need, when they – after 14 years from now – enter the labour market or go to college? This out-of-the-box thinking has resulted in lots of investments in aligning labour market needs and workforce education programmes. This trend is amplified by theoretical notions of experiential (Kolb 1984), authentic (Donovan et al. 1999) and workplace learning (Malloch et al. 2011).

But to what extent is competence-based education a novel and promising innovation? Or is it an eroded and failed approach to link work-related education to the labour market and to train students in narrow skills and give them a useless qualification? What is competence in the first place (Le Deist and Winterton 2005)? It is known that the concept of competence has a long history (Mulder 2014). The notion of competence, as knowing who is good enough to perform certain activities, is probably as old as humanity. Early accounts can be found in the Persian (seventeenth century BCE), Greek (third century BCE), Latin and Western European languages (sixteenth century AD). In the beginning of the twentieth century, the concept of competence was also used in academic publications (see Dewey 1916), but it was not yet used as an academic construct.

1.3 The Construct in Science and Practice

During the second half of the twentieth century, the theoretical construct of competence was introduced in various domains, such as in psychology, education, performance management and corporate strategy. These developments will be shortly described here, by following a review of the professional competence literature (Mulder 2014).

In psychology, White (1959) saw competence as an alternative construct for the drive theory of Freud and defined competence in terms of the innate motivation to master skills, like a young child that wants to learn to crawl, walk or speak. Freud contended that performance was in most cases sexually driven. White stated on the other hand that performance is driven by the will to master. On this psychological view, the later performance motivation theory was founded. The early work of Argyris (1962, 1965a, b, 1968) built upon the work of White and studied interpersonal competence from a behavioural psychology perspective.

The disconnection between education and the world of work or job success was shown by McClelland (1973). He made a plea for testing on competence instead of on intelligence; at that time intelligence testing was the dominant approach in test psychology. However, the application of these tests, and the mere construct of general intelligence, was heavily contested. The opinion of McClelland was that tests of human performance should be based on showing and assessing that performance in practice.

During these years, competence-based education in the USA was introduced as a response to the lack of societal relevance of many educational programmes. There were many innovation projects in which competence-based education was implemented. Norton et al. (1978) and Grant et al. (1979) described the design and implementation of competence-based education. The first evaluations were quite critical, such as in teacher education literature, in which Competency-Based Teacher Education (CBTE) was contrasted with Humanistic-Based Teacher Education (HBTE). CBTE was seen as being too behaviouristic, atomistic, functionalistic and controlled. Based on theories of Maslow (1943) and Rogers (1969), more value was attached to higher levels of self-realisation, student-centred learning and personal and identity development. Based on the student movements of the 1960s, critiques on the capitalist society and the replication of structural socio-economic inequalities by education, there were various neo-Marxist sociological and political views proposing radical changes in education (Freire 1968; Illich 1971; Apple 1972).

Because of these developments, much of the competence-based education movement was silenced, although general discontent with the detachment between education and society was not over. People believed that education remained in an ivory tower, that curricula were often outdated before they were even fully implemented and that the education system was failing to meet the needs of the labour market. Moreover, teachers could not keep up with rapid developments in business and industry, leading to pleas for organising internships for teachers in companies and facilitating guest lectures of relevant professionals from the world of work.

Gilbert (1978) consequently suggested connecting competence development with performance improvement, arguing that the performance improvement potential (PIP) is a much more positive indicator of human behaviour than the intelligence quotient (IQ). His work was more popular in business contexts than in education. However, it sparked interest in developing the field of performance improvement technology which became quite popular in general and human resource management. This movement also resulted in thinking about performance support systems. A classic example of this is of the pizza couriers who delivered pizza boxes which were crushed so that the box stuck to the pizza. More training of how to deliver pizzas was not effective, but placing a small plastic scaffold in the box did the trick. It prevented the box from crushing. In workplaces today there are many smart performance support systems, many of which are digital in nature and embedded in daily work processes.

At a higher level of organisational thinking, Prahalad and Hamel (1990) applied the construct of competence in the field of corporate strategy. They convincingly showed that organisations which followed a strategy based on core competence did

better. It resulted in the trend of focusing on the core competence of the organisation and outsourcing all secondary business functions. The long-term effect of this lean-and-mean strategy was not purely positive, as business functions which were outsourced resulted in companies who could also deliver their services to other companies and some of them even became competitors of their original parent companies (Arruñada and Vázquez 2006).

The work of Prahalad and Hamel on corporate strategy resonated well in educational board rooms. Many schools and colleges still had to deal with the public perception that their programmes lacked societal relevance. They saw the core competence movement as an alternative to the earlier attempts to implement competence-based education via educational policy-making and human resource management in schools. Human resource consultancy firms jumped in the gap in the market to develop competence-based management frameworks, competency dictionaries and tools for competence-based selection and assessment. First companies, and later schools and even universities, massively bought these services or developed and implemented their own systems (Mulder 2001a, b).

What was especially appealing in the approach of Prahalad and Hamel was that it triggered the idea that strategy should be focused on doing things in which organisations excelled. Translated to education that implied that schools and colleges had to focus on talents of students. This creates much more positive energy than when schools and colleges focus on things their students cannot do. This view of Prahalad and Hamel also helped educational institutions with their decision-making regarding their educational objectives, concentrating on the core objectives of education and educational programmes. A main problem of many educational programmes is that they are containerships stacked with course units or modules which are inserted by departments or faculty members under the umbrella of a programme name, but which are really incoherent sets of overloaded and overspecialised introductions into disciplinary knowledge domains. A common remark of the respective faculty is that there is too little time to teach the units and that more time is needed to address even more knowledge of the same specialisation. However, what is lacking is the understanding that there is never time enough to teach all knowledge from a certain field. Instead, educators need to think about the core competencies which are important, and learning to learn is certainly one of them. That means that curriculum units in a competence-based learning environment serve as introductions to enable graduates to develop themselves further in the field.

The notion that core competence is essential in steering organisations based on what they are good at also entered the field of professional development and licensure. It encouraged professional associations to think about the core of their professions. Many developed competence frameworks which served as representations of that core. There are plenty of examples of research and development studies which delivered competence frameworks, such as in purchasing (Mulder et al. 2005), extension (Karbasioun et al. 2007), open innovation (Du Chatenier et al. 2010), entrepreneurship (Mulder et al. 2007a; Lans et al. 2010) and sustainable development (Wiek et al. 2011; Wesselink and Wals 2011), to name a few.

Since the introduction of the construct of competence, various conceptual analyses, reviews and research papers have been published (Ellström 1997; Rothwell and Lindholm 1999; Sandberg 2000; Hager 2004; Le Deist and Winterton 2005; Mulder 2014). As with many new concepts in social science, many authors have given different definitions of 'competence' and 'competency', and reviewers have pointed at the different dimensions that have been reflected in these definitions.

Furthermore, various authors have heavily criticised the concept (Hyland 2006; Mulder et al. 2007b); some even suggested to completely delete the concept from the professional and academic dictionary because of its ill-defined nature, lack of explanatory power and limited value added in practice (Westera 2001).

Some of the critiques are valid, some exaggerated, but the concept of competence proved extremely resilient arguably becoming *the* defining characteristic of European policies on employment, education and training. This is shown in this section, which is largely based on Winterton (2011). From November 1997, when the European Employment Strategy (EES) was launched at the Luxembourg Summit, measures to improve employability and adaptability have been adopted to combat unemployment, raise the employment rate, increase worker mobility and improve education-to-work transition (EC 1997). Developing the competence of the working population was one of the key mechanisms of the EES, and the high skills strategy launched at the Lisbon Summit in March 2000 reinforced this imperative, establishing a policy objective of making Europe *by 2010* 'the most competitive and knowledge-based economy in the world capable of sustainable growth and better jobs and greater social cohesion' (EC 2000: para. 5).

Lisbon marked the beginning of a new European policy framework for education and training, establishing targets and benchmarks and linking these with the EES and policy initiatives on Lifelong Learning that were developed in parallel (CEC 2000). After consulting member states, the Commission produced a report in January 2001 proposing means for raising the standard of learning in line with the Lisbon objectives (Cedefop 2003), whilst the Barcelona summit (March 2002) set the objective of making European education and training systems a world-quality reference by 2010 (CEC 2002b). In pursuit of this high skills agenda, the Commission also published an *Action Plan for Skills and Mobility* in February 2002, emphasising the need to increase occupational mobility of workers from the poorer regions to those of the wealthier regions of the EU (CEC 2002a).

The adoption of competence-based VET and outcome-based higher education was driven by the need to make education and training more responsive to changing labour market needs, supporting the employability and adaptability imperatives of the EES as well as the high skills goals of the Lisbon Strategy and later by *Europe 2020*. Competence was seen to offer a unifying concept bridging the 'parallel universes' of VET and HE, thereby facilitating permeability (transfer between VET and higher education in either direction) and labour mobility (in career, sectoral and geographic senses) as well as being the foundation for accreditation of prior learning and recognition of work experience. The Lisbon Summit called for 'reflection on concrete future objectives of education systems focusing on common concerns and priorities while respecting national diversity' (EC 2000: para. 27). However,

national diversity in approaches to competence proved one of the major obstacles to developing European-wide instruments.

An important part of the rationale for this volume is this continued confusion and diversity in approaches to competence that make coordinated policies so difficult to design and implement. The provenance of different competence models and qualifications systems can easily be traced to the specific historical and cultural traditions that led to distinctive forms of labour market regulation, training regimes and work cultures (Brockmann et al. 2009, 2011; Winterton 2009). These origins explain why it is so difficult to develop a common European framework for competence, since the institutions and processes in which the models are rooted have endured. For two decades EU policy initiatives have struggled to establish a common European competence model that can accommodate these differences, and the challenge of developing European policy instruments is to align the different competence models (using approximation rather than harmonisation).

The development of a typology of 'knowledge, skills and competence' for the European Credit Transfer System for VET (ECVET) offered insight into how such a 'best fit' approximation could be undertaken (Winterton et al. 2006) even though the ultimate outcome demonstrated the pitfalls of incorporating technical and political interests when developing such frameworks. The Directors-General for VET in their Autumn 2001 Bruges meeting had agreed on further efforts to enhance European-wide cooperation and in the Copenhagen Declaration (2002) gave a commitment to develop ECVET. The Commission established a Technical Working Group (TWG) in November 2002 with representatives of member states to develop the principles. Cedefop, which provided the secretariat for the TWG, commissioned underpinning research to design the ECVET architecture: the credit transfer system (Le Mouillour 2005), reference levels for qualifications (Coles and Oates 2005) and a typology of knowledge, skills and competence (Winterton et al. 2006).

The typology proposed identified four analytically distinct sets of competencies as a way of reconciling the three main European competence models and recommended adopting the terminology of cognitive competence (for knowledge), functional competence (for skills) and social competence (covering attitudes and behaviours). It was also recommended that the term competence without an adjective should be understood as an umbrella term including all three dimensions in a work context. The TWG, however, retained the terminology of the original remit, and in the note elaborated by the Commission (CEC 2004), for the adoption of ECVET at the Maastricht summit on 14 December 2004, as well as in subsequent ECVET documentation, the phrase 'knowledge, skills and competences' was employed without further definition.

During the development of ECVET, the Berlin Communiqué (2003) recommended replacing notional workload time with learning outcomes in higher education as part of moves to establish an overarching framework of qualifications for the European Higher Education Area. The parallel European Credit Transfer Systems (ECTS) for higher education, extended to all member states under the Bologna Declaration (1999), was based on notional workload input rather than competence (CEC 2003; Winterton 2005), and the notion of a single qualifications framework

encompassing both VET and higher education required higher education to adopt competence-based learning outcomes.

The Expert Group convened by the Commission to develop proposals for a European Qualifications Framework (EQF) retained knowledge and skills in their typology but replaced competence with 'personal and professional competence' (Markowitsch and Loumi-Messerer 2008: 37), which was further subdivided into autonomy and responsibility, learning competence, communication and social competence, and professional and vocational competence. A conference convened in Budapest in February 2006 to consider the EQF proposals redefined competence as 'learning outcomes in context', whilst another expert group tasked with redesigning the descriptors replaced competence entirely with 'learning outcomes' comprising knowledge, skills, and responsibility and autonomy, under which there was a move to subsume 'competence' (Markowitsch and Loumi-Messerer 2008: 42). A further TWG established in May 2006 with representatives from member states finally restored competence in place of 'responsibility and autonomy' but expressed as 'competence (responsibility and autonomy)'.

As subsequent European policy instruments were developed, even greater confusion was introduced, with increasingly divergent definitions of competence. After a midterm assessment of the Lisbon Strategy in 2004 found progress disappointing, a revised Lisbon Strategy was unveiled (CEC 2005a p. 1). The emphasis was again on increasing adaptability and flexibility of firms and workers to enable Europe to adjust to restructuring in the light of global market changes, simplifying mutual recognition of qualifications to facilitate labour mobility and investing more in human capital. In November 2005, the Commission proposed a framework of *Key Competences for Lifelong Learning* (CEC 2005b) which included a European Reference Framework on basic skills, defining competence as 'a combination of knowledge, skills and attitudes appropriate to a particular situation' (p. 2 of Annex), and key competencies as supporting 'personal fulfilment, social inclusion, active citizenship and employment' (p. 3 of Annex).

With the onset of the Global Financial Crisis, the Commission published *A European Economic Recovery Plan* (CEC 2008a), outlining four strategic aims: to stimulate demand and boost consumer confidence; to lessen the human cost of the economic downturn and its impact on the most vulnerable; to ensure that when growth returns, the European economy is in tune with the demands of competitiveness; and to accelerate the shift towards a low carbon economy. Supporting training and development initiatives were outlined in *New Skills for New Jobs* (CEC 2008b), which reiterated the need to enhance human capital and employability as well as ensuring the alignment of skills supply with labour market demand. *New Skills for New Jobs* was designed to anticipate future skills needs, to develop strategies to raise the overall skill level of the European labour force and to reduce skills mismatches in the European economy. The expert group supporting this initiative recommended a T-shaped competence profile where transversal skills (the horizontal bar) are combined with job-specific skills (the vertical bar).

In the face of a deepening economic crisis, the Brussels Summit in March 2010 endorsed *Europe 2020* as a new strategy for European economic recovery (CEC

2010). Providing relevant, high-quality skills and competences was seen as a key part of the strategy (Bruges Communiqué 2010; Council of the European Union 2011), but as the *Transferable Skills* project noted, in interim findings presented in November 2010, there was still no agreed competence model at EU level. The *Transferable Skills* project therefore adopted the knowledge, skills and attitudes model of the European reference framework *Key Competences for Lifelong Learning* (CEC 2007), supplementing this with individual 'characteristics' (including inborn or acquired psychosocial characteristics), thereby confusing 'input' characteristics with 'output' competencies.

Competing definitions of competence in European policy instruments derive less from the longstanding national differences in approaches to competence and more from inherent confusion in the theoretical underpinnings of the work on which they are based. The EQF, adopted on 23 April 2008, was designed to offer a facilitating framework for mapping qualifications using knowledge, skills and competence descriptors (CEC 2008c). In the EQF, knowledge is described as 'theoretical and/or factual knowledge', skills as 'cognitive skills (use of logical, intuitive and creative thinking and practical skills (involving manual dexterity) and use of methods, materials, tools and instruments)', and competence is described 'in the sense of the assumption of responsibility and autonomy' (Sellin 2008: 15). Most European countries have either aligned their National Qualifications Frameworks with the EQF or are in the process of doing so (Hanf and Rein 2008; Hozjan 2008; Tierney and Clarke 2008; Tūtlys and Winterton 2006), and many problems have been encountered in the process (Bohlinger 2008). Markowitsch and Loumi-Messerer (2008: 53) argue that some of the problems stem from three implicit hierarchies operating within the EQF: an educational (or systemic knowledge) hierarchy, an occupational (or competence) hierarchy and a skills (or individual attributes) hierarchy. Through the lens of each hierarchy, the EQF takes on a different aspect.

Various EU instruments have been developed to support the alignment of qualifications and competence models, but far from resolving the difficulties, these have introduced further conceptual confusion and discrepancies (Winterton 2011). For example, in 2010, the Report of an Expert Group, established to propose ways of developing the *New Skills for New Jobs* initiative in the context of Europe 2020, demonstrated the inherent confusion in policy thinking with a definition of skill that is, to say the least, idiosyncratic:

> Throughout this report, the term 'skill' subsumes knowledge, skill and competence defined in the European Qualifications Framework, where 'skills' means the ability to apply knowledge and use know-how to complete tasks and solve problems, and 'competence' means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development. (EU 2010: 4)

European agencies have even published misleading comments, suggesting, for example, that the zones of mutual trust in the reference levels document produced by Coles and Oates (2005) for ECVET were somehow a conceptual alternative to the competence typology (Bohlinger 2008: 101), whereas Coles and Oates explicitly incorporated the typology in their explanation of how such trust is developed.

Notwithstanding the numerous difficulties, competence has attained a pivotal structural position in international educational policy and administration well beyond the increasing popularity of competence-based education at the level of local schools and national educational frameworks (Winterton and Haworth 2013). Despite the difficulties noted above, the EQF is one of the most prominent examples of the policy influence of the competence movement (Brockmann et al. 2011; Council of the European Union 2004, 2008; Mulder 2012). Competence development is the cornerstone of many lifelong learning agendas (Council of the European Union 2008), including those of the European social partners (European Social Partners 2006; Winterton 2000). On a wider scale, there is ample experience with the implementation of competence-based education in the Americas (Houston 1974; U.S. Department of Education, National Center for Education Statistics 2002) and Australia (Gonczi 1996; Arguelles and Gonczi 2000); various countries in Africa (Mulder and Gulikers 2011) and Asia (Nederstigt and Mulder 2011) also have adopted competence-based education development agendas, which are partly influenced by western education development agencies and institutions like UNESCO (including UNEVOC), the OECD (Rychen and Salganik 2003), the World Bank and the ILO.

So the concept of competence, after having been used for centuries in daily language and having circulated around half a century in motivation psychology, business management and educational sciences, is now institutionalised, whether we like it or not.

The institutionalisation of the competence philosophy in international educational policy and administration process mainly serves an operationalisation function in the comparison of educational levels, which in turn is worthwhile for transparency and mobility reasons. For instance, if nurses or medical doctors, engineers, computer scientists or accountants from southern European countries wish to migrate to western European countries, or the other way around, diploma comparison is easier if the educational programmes of these professionals can be compared via the EQF as reference framework. The idea behind this is that the EQF would facilitate labour mobility. Indeed, qualifications in regulated professions such as medicine and pharmacy were already aligned in Europe through a process of 'homologation' long before the EQF was conceived.

However, competence-based education includes more than the international educational policy-making and international or national qualification, certification or credit frameworks. It is also about the actual implementation of competence-based curricula, instruction and assessment in practice. At this level, there are also different ways in which competence-based educational philosophy is used, such as in curriculum redesign, the design of instructional processes, competence assessment, human resource management and teacher professional development. There have been various implementation challenges, as has been pointed out in numerous publications (Biemans et al. 2004, 2009; Winterton 2011). Instrumental guidelines were developed to overcome barriers and to support management and teachers to better implement this innovation, within a policy framework that promoted competence-based education.

This actual use of and experience with the competence concept in daily educational practice, like in the development and use of competence frameworks of medical doctors, nurses, financial advisors and teachers, in the development and implementation of competence-based education and assessment practices, have had a tremendous impact on the discussion of its worth. Because of many parallel measures, like over-standardisation in education, austerity measures, narrowing job profiles as a basis for skill-based training programmes and reorganisation, the debate on competence got contaminated by experiences with, perceptions of and opinions on these measures, especially because in various cases the implementation of these measures was justified by the relevant stakeholders by emphasising the expected benefits of competence-based education. Moreover, scholars who were adhering to other paradigms of education contended that there was no underpinning theory, sound empirical research evidence nor extensive practical experience with the competence movement and that competence was nothing more than a metaphor.

1.4 Definitions

A major issue in the uncertainty and multiplicity of understandings of competence is in how the concept is defined. Many definitions circulate, and global consensus seems to be hard to reach. It may be wise to look at the Webster first to see what the common understanding of competence is. The dictionary says:

'**competence** *n* (1632) (**1**) a sufficiency of means for the necessities and conveniences of life < provided his family with the comfortable ~ – Rex Ingamells > (**2**) the quality or state of being competent: as (**a**) the properties of an embryonic field that enable it to respond in a characteristic manner to an organizer (**b**) readiness of bacteria to undergo genetic transformation (**3**) the knowledge that enables a person to speak and understand a language – compare PERFORMANCE

competency *n, pl* –cies (1596): COMPETENCE

competent *adj* [ME, suitable, fr. MF & L; MF, fr. L. *competent–*, *competens*, fr. prp. or *competere*] (14c) (**1**) having requisite or adequate ability or qualities : FIT < a ~ workman > < a ~ piece of work > (**2**) proper or rightly pertinent (**3**) legally qualified or adequate < a ~ witness > (**4**) having the capacity to function or develop in a particular way; *specif* : having the capacity to respond (as by producing an antibody) to an antigenic determinant < immunologically ~ cells > ***syn*** see SUFFICIENT – competently *adv*'

A lot can be learned from these descriptions. We will not go into the fourth meaning of competence as given in the definition, which was and still is used in cell biology. See, for instance, the work of Shiver et al. (2002) on replication incompetence of a vaccine vector which is of influence on immunity. The essence here is that the capacity of organisms to respond to intruders is also called competence. That is in line with how we see professional competence.

What can be learned first of all is (and what is mentioned above already) that 'competence' is a noun which was already in usage in the seventeenth century. It has several meanings. In the first place, it is about 'a sufficiency of means for the necessities and conveniences of life', which means in current times that a person has *sufficient resources*, including employment and career competence for maintaining a livelihood and a personal lifestyle. Secondly, it means 'the quality or state of being competent', which is illustrated by three ways of using this meaning, stressing the *properties* that enable to respond (as in the example from cell biochemistry), the *readiness* to undergo transformation and the *knowledge* to use a language. This means that in these few sentences, we already have six related but different meanings of competence as resources, quality of being, state of being, properties, readiness, and knowledge.

From the description of competency, which is also a noun, we can learn that it was already used in the sixteenth century. The plural is competencies, which is interesting, because there is no plural indicated in the description of competence. That is also understandable as competence is seen as a general state of being, a quality of being, as having sufficient resources, as properties, readiness and knowledge. That understanding of competence makes the plural competences meaningless. Because what would be the plural of the state of being, the states of being, or of the readiness to change, the 'readinesses'? That does not make real sense. Therefore, competence is often regarded as the most generic description of what people are able to do. Competency itself is not further described in the dictionary; it refers to competence, as if both would be synonymous, which, in the current understanding is not the case.

The concept 'competent' is an adjective or adverb; relates to being suitable and the French/Latin competent, competens or competere; and can be used in phrases as this person is very competent, or that is a very competent behaviour. The description indicates four ways of using 'competent', first of all as having conditional or sufficient ability or qualities, which is linked to the resources and quality of being mentioned above. Secondly it is used in the meaning of being rightly appropriate. We can think of a phrase like 'this is a competent solution for this specific problem', which means it is adequate in the given situation. Thirdly, competent is used as legally qualified or adequate. This juridical meaning is different from all other descriptions of the concepts in the dictionary, but it is still used to indicate the legal powers of certain people or institutions, and a competent authority in the legal sense is one that is deemed also to possess the requisite abilities. Fourth, competent means the ability to function or develop. This meaning comes very close to what many scholars understand as being competent.

So for the concept 'competent', there are four meanings which are distinguished. These are as follows: (1) having conditional or sufficient ability or qualities, (2) adequate, (3) legally qualified or adequate and (4) the ability to function or develop.

In Webster's Dictionary, the core of the concept 'competence' is therefore a combination of having resources, a quality or state of being, properties, readiness and knowledge to maintain a livelihood, being able to respond, to undergo transformation or to use a language. In general and current language, these meanings can be

described by the capability to make a living, the characteristics of persons that make them competent, the ability to adapt and change and knowledge. Knowledge, as in the ability to use a language, is possibly a somewhat strange meaning of competence, as generally there is more needed to perform like speaking or reading, which is skill. But this meaning of competence is interesting as it goes against the general reactions on competence-based education which state that in this educational philosophy – or rather practice – knowledge is undervalued. Apparently conceptually not, as it is included in the description of the concept.

Also in Webster's Dictionary, the concept of 'competent' is a combination of having abilities or qualities, being adequate or qualified and ability to function or develop. There are a couple of things which are striking here. First of all, it is interesting to note that this meaning of competent goes against opinions which state that competence or being competent is aimed at a bare minimum of performance. Services and goods which are just acceptable mostly do not meet the expectations of supervisors, employers and above all clients. The phrase adequate may be interpreted in that minimalistic way but is in fact more positive than minimal or acceptable. Having conditional or sufficient qualities does not necessarily mean that they are 'just enough': it all depends upon how high the bar is placed. Obviously competent does not convey the same impression as excellent, and there are of course gradients of competence. If medical specialists are described as very competent, that means they are seen as excellent doctors. Now excellence itself is not the same a brilliance, which implies an even higher level of ability. Secondly, it is also interesting to note that competent is seen as the capacity to develop. So, a competent medical practitioner would be someone who can further develop, as in lifelong learning, keeping up with innovations in the profession and further specialise in a certain direction. Thirdly, the notion of legality comes in, which corresponds with the fact that the concept competent is also being used in law. In the dictionary it says that a witness can be declared competent. The opposite can also be the case: a witness can be declared incompetent, for instance, based on personality disorders or intelligence impairment. But more generally, institutions can also be declared competent, which means that they have the right to perform certain tasks, or to take certain decisions. This holds for various local, regional, national and international institutions which exert a certain power, such as governments, parliaments, courts of justice, committees and commissions. Fourthly, being competent also means being qualified, which implies that there should be a person, organisation or institution which can decide whether an individual is qualified. In the context of this volume, this is obviously the educational institute. But beyond that, competence assessment organisations, accreditation bodies, inspectorates and ministries also play a role.

Now, what can be learned from this detailed analysis of the concepts 'competence', 'competency' and 'competent' as described in Webster's Dictionary?

Briefly then, 'competence' is seen as resourcefulness, a quality or state of being and a set of properties which enable transformation and performance in various ways, and 'competent' as having abilities or qualities in general, having the ability to function or develop and being adequate or qualified.

So both concepts of competence and competent entail meanings of having and being, in the sense of having competence and being in a state of competence, and having abilities or qualities and being competent; in general this distinction can be summarised in that someone *is* competent and *has* competence (and therefore possesses certain competencies).

In the descriptions of competence and competent, there are references to properties, abilities and qualities. These are all plural, which are the competencies that together constitute competence.

Based on this linguistic analysis and previous scientific reviews, we propose to define the core concepts in this volume as follows.

Competence
Competence is the state of being able, or the generic capability which is a necessary requirement to perform; the set of characteristics which enable performance; e.g. she has the competence of being a good intensive care nurse. When related to vocational and professional education, the concept can also be defined in other words: 'Professional competence is seen as the generic, integrated and internalized capability to deliver sustainable effective (worthy) performance (including problem solving, realizing innovation, and creating transformation) in a certain professional domain, job, role, organizational context, and task situation' (Mulder 2014).

Competent
Competent is being adequate or qualified and having the abilities or qualities to function and develop; e.g. he is a competent cardiovascular surgeon.

Competency
Competency is an element and characteristic of competence; e.g. this researcher has a binding leadership ability. In other words 'A competency is a part of generic competence; it is a coherent cluster of knowledge, skills and attitudes which can be utilized in real performance contexts' (Mulder 2014).

Competencies
Competencies is the plural of competency, e.g. the framework of competencies of teachers.

We do not define 'competences' here, although it is used in mainly policy-oriented literature, for the reason mentioned above, which is that competence is defined here in itself as the generic state of being competent. Competences in the European Qualifications Framework (EQF) go against the definitions here, as a competency is seen as an integrated mix of knowledge, skills and attitude elements. For instance, as a follow-up on the previous example of entrepreneurship, the competency of entrepreneurship is here seen as a combination of knowledge domains on and for entrepreneurship, skills to identify and utilise business opportunities and attitudes to pursue results and success and to create value. The EQF however has separated knowledge and skills, and even set competences aside (as we have seen above), as a result of which the whole notion of integrated capabilities in the defini-

tions proposed here is demolished. Competences in the EQF are seen as levels at which graduates are able to perform tasks. At the lowest level, they are expected to only perform tasks which are simple and are carried out under direct supervision and in a context which is very structured. At the highest (PhD) level, candidates are expected to perform independently, add to science in terms of complex concepts and theories and to show leadership in knowledge development.

Apart from the use of 'competences' in the EQF, 'competences' are also used for European institutions, and seen as the decision-making powers of the Union (Article 5 (1), TEU stipulates: 'The limits of Union competences are governed by the principle of conferral. The use of Union competences is governed by the principles of subsidiarity and proportionality'. This use of competence in institutional contexts, however, will not be further elaborated here.

1.5 Contexts and Functions

As published already in a niche journal (Mulder 2001a) and in a report on a broad study on competence development in organisations (Mulder 2001b), there are several contexts in which the concept of competence is being used. These contexts include (1) the organisation, (2) personnel management, (3) human resource development, (4) the interface between education and work, (5) continuing professional development and (6) sectoral education and training policy.

As will be clear, the use of competence-based instruments at the interface between *education and work* is precisely the topic of this volume. The sometimes weak connection between the worlds of education and work can be made stronger by using agreed competence frameworks which reflect the demand for qualifications in the labour market, or more broadly in society, and the supply of educational programmes offered by educational institutions.

The *sectoral training policy or economic structure policy* context is also relevant for vocational and professional education, as it defines the direction in which this will develop. A returning issue within sectoral training policy is to what extent vocational and professional education should be specialised. This debate is often influenced by the state of the economy. During times of recession, broad education is often recommended, especially in programmes for which there is little demand, as it will give graduates more opportunities for employment. Teacher education is a good example of this. During times in which it was hard to get a job in schools, teacher training colleges tended to broaden their curriculum so as to give graduates the opportunity to find employment outside education. In sectors experiencing labour shortages, such as in engineering and production technology, sectoral employers' organisations may insist on narrowing qualifications and corresponding competence frameworks, both to bring graduates to the labour market more quickly and to reduce their mobility into other sectors. This happened, for instance, in the oil and gas industry where there was a shortage of specific welders and off-shore

technicians. Unions are not usually keen on these width reductions, fearing lower wages, higher employability risks and more vulnerability to labour contracting.

But the use of competence instruments is much wider, as we briefly elaborate below. At the level of *organisational strategy*, (boards of) directors and management take decisions about the future course of the organisation, and in this decision-making process, the core competence of the organisation, competence levels of the workforce and competence development consequences of change and innovation may play a role. Although the core competence of the organisation is hard to change in the short term, it may be subject to reassessment. The same holds for competence levels of the employees in the organisation. Their collective competence is deeply rooted in all branches, but when qualification levels have to rise because primary processes are becoming more and more complex, whole groups of employees may need further education and training or face the risk of redundancy. This, for instance, happened in the health-care sector where employees had to undergo massive training and development to keep abreast of developments in primary care.

In *personnel management*, or human resource management (HRM), it has been observed that selection, assessment and training practices often use different instruments. In selection, job responsibilities, required qualifications and competencies are often specified, whereas in assessment task performance and other competence frameworks may be used. It sometimes even happens that organisations use competence frameworks for the different job families and other competency lists for annual results and development meetings. Trainers often use their own toolkit to do training needs assessments to develop their training programmes. These may or may not include competence frameworks. The merit of competence-based personnel management and well-developed and agreed competence frameworks in organisations is that it can provide a common language for all HRM practices, including selection and hiring, assessment and training and development. In practice there are elaborate examples of this; there are organisations in which competence frameworks play a crucial role in advertising vacancies, managing expectations of candidates who opt for certain positions, the preparation of a self-assessment or an assessment by an assessment bureau, the composition of learning trajectories towards qualifications for certain jobs, the evaluation of candidates for certain positions, the performance appraisal of employees via supervisor or multi-rater assessments and defining priorities in personal development and performance improvement plans. Organisations that adopt comprehensive competence-based HRM embody statements of competence from occupational standards and all HRM systems and processes and link these to strategic organisational and business goals (see the figure from Leman et al. 1994 reproduced in Winterton and Winterton 1999: 15).

In *training and development*, ample use has been made of competence standards, frameworks, dictionaries and models. They all serve as input for identifying learning needs. There are situations in which ready-to-use competence frameworks are adopted, but developing these together with co-workers may be more effective, because in this process the meaning of the competencies and the mutual expectations get clearer than in the implementation of competence frameworks developed by others. It is not so much a matter of not invented here, which causes issues in the

use of predefined competence frameworks, but mainly a matter of joint understanding of what is and can be expected in terms of job performance and what is needed in terms of competence development. The process-oriented approach leads to more commitment for this development. Moreover, involving employees in the elaboration of a competence framework can facilitate identifying the boundaries of tacit knowledge and skills that are often more important in the execution of work tasks than the content of formally defined competence frameworks (Polanyi 1967).

In the *professional development* context, competence standards, lists, dictionaries and frameworks can play a similar role as in education and training. They may be used to make an inventory of development needs, to guide the progression of development plans and to assess progress of development. They however are also being used for registration, licensure and certification purposes. Certain professions have, or are in the process of creating, a register of professionals in which individuals are included only if they meet admission and assessment criteria. This holds for medical professionals, but the teaching profession is also proposing to use registers of qualified professionals. Typically, next to specified initial professional education further guided professional development, peer review and a mix of supervised professional practice and intervision are required. This can all be accumulated in a portfolio (digital or not), which can be submitted to accreditation and reaccreditation bodies responsible for deciding which individuals qualify for inclusion in the register. Lawyers, medical doctors and psychologists can all be removed from the register based on non-compliance with continuing professional development requirements or demonstrably culpable misconduct verified by a court.

As is clear from this description, the contexts of using competence instruments like competence frameworks, competence assessments and competence-based training programmes differ, but the competence development processes in these contexts are essentially the same. Students in vocational and professional education should be made aware of what role competence plays in the assessment of their portfolio when they are applying for jobs, in the evaluation of their interviews, the daily execution of job tasks, performance appraisals and elaboration of personal development plans. They should understand the importance of their competence profile for directing their process of career-oriented learning.

The functions of working with competence instruments are somewhat related to the contexts in which are being used.

Within corporate training, education and development, competence instruments can have different performance improvement objectives: (1) alignment, (2) strategic, (3) communicative, (4) dynamic, (5) developmental, (6) employability and (7) performance improvement.

Regarding *alignment*, the very purpose of using competence frameworks for curriculum development is to link learning outcomes, learning processes and assessment practices to expectations of graduate attributes or desired performance in society. A competence framework serves as the link between the collective demands of society and the profile of the curricula offered by the educational institutions involved (see Chap. 11 on competence and the alignment of education and work in this volume). The frameworks need not to be interpreted as rigid and minimalistic,

behaviourally specified laundry lists of tiny competencies which can be checked off. Whereas early attempts to create competence frameworks typically involved such lists, current competence frameworks are of a much more holistic nature and are development oriented, aiming at higher levels of learning and understanding, as well as the formation of professional identity.

In corporate training, education and development, a distinction is made between vertical and horizontal alignment. The difference between the two is that in vertical alignment, processes at various organisation levels, such as the strategic, HR and training level, are being aligned, whereas in horizontal alignment various HR practices are being tuned, such as recruitment and selection, assessment and remuneration and training and development. As already explained above, these practices are often implemented using different HR instruments, and competence instruments can be used to provide a set of tools and common language, the 'glue', to create synergy between these practices.

Developmental, *employability and performance improvement* functions are also applicable in the vocational and professional education context. Obviously, vocational and professional education is aimed at competence development of students, their future employability and continuous performance improvement.

However, within vocational and professional education, competence instruments can also be used for realising the other functions. In terms of *strategy development*, educational institutions can use the concept of core competence to direct organisations in the desired direction. Of course, intensive deliberation and decision-making are needed to achieve sufficient consensus on this direction, as there are many competing visions on innovation in education. But focusing on the present and desired core competence of schools or colleges and the current and desired competence base of professionals working in these institutions can result in a strong but also realistic innovation process.

Competence frameworks, whether adopted or developed in-house, can be powerful tools in *communication* about current issues at work, plans for the future and expectations of all involved. Competence frameworks provide ingredients for understanding one another, which is very much needed because many innovations remain hanging in the air: they are comfortably formulated in general terms, leaving room for interpretation and choosing to adopt the innovations that appeal, which usually means those that involve little or no change in practice.

Working with competence instruments may also create a *dynamic* atmosphere in educational institutions, especially when taken seriously by management. In many business contexts, competence frameworks are defined around products and services being produced or delivered by the organisation and the roles in which employees are expected to contribute. A product manager may, for instance, be expected to be entrepreneurial. Or a salesperson may be expected to think systemically, which implies thinking not only about sales but also the production or delivery process, which is a recurrent source of tension between employees in sales and production positions. Functions have had the negative connotation of being inflexible, rigid, part of a function framework, tightly connected to task and performance descriptions, separating them from other functions and, as a consequence, discour-

aging cooperation. The 'not-in-my-job-description' complaint is frequently heard in organisations operating on functionalist lines. Working with roles and competencies creates the possibility to encompass organisational inertia caused by functionalistic work organisation and task division. Joint responsibility for certain work processes can lead to dynamic working situations in which co-workers can take over certain tasks from each other when needed.

1.6 Competence-based and Competence-oriented Vocational and Professional Education

The title of this volume is 'Competence-based Vocational and Professional Education'. In this section the scope of this volume is further explained. The title is deliberately not competence-oriented education. There is a significant difference between competence-based and competence-oriented education. Furthermore, the title includes vocational and professional education, also two distinct terms which reflect different education systems and occupational levels. It does not include terms like Technical Vocational Education and Training (TVET), Career Technical Education (CTE), Post-Secondary Education, Further Education, Community College Education, Professional College Education, Professional University Education, Academic Education and Workforce Education of Workforce Development (see Mulder 2012, for an elaboration of this), although the volume conceptually includes all these education systems. Vocational and professional education is aimed at preparing future workers and professionals for the labour market, including entrepreneurs, who, rather than seeking jobs, will be creating them.

However, regarding vocational and professional education, a precautionary remark needs to be made. In many parts of the world, vocational and professional education are actually perceived as no-go areas. The general opinion in those places is that students can better take a general education and look for appropriate employment opportunities afterwards and rely on workplace learning opportunities to develop their professional competence. However, there is a legitimate place for vocational and professional education, education which prepares students for certain job families, occupations or professions. It is evident that there is no debate about the importance and status of educational trajectories for future medical doctors and specialists. On the contrary, however, vocational education should also have sufficient esteem. At a global level, large numbers of workers are needed to sustain and further develop society. This has rightfully been acknowledged by the United Nations Universal Declaration of Human Rights in article 26 on education, which states: (1) 'Everyone has the right to education. Education shall be free, at least in the elementary and fundamental stages. Elementary education shall be compulsory. Technical and professional education shall be made generally available and higher education shall be equally accessible to all on the basis of merit. (2) Education shall be directed to the full development of the human personality and to the

strengthening of respect for human rights and fundamental freedoms. It shall promote understanding, tolerance and friendship among all nations, racial or religious groups, and shall further the activities of the United Nations for the maintenance of peace. (3) Parents have a prior right to choose the kind of education that shall be given to their children' (Source: http://www.un.org/en/documents/udhr/).

The first section of this article 26 says: 'Technical and professional education shall be made generally available'. This is a very strong statement in favour of vocational and professional education with all variations mentioned above. Both vocational and professional education can derive authority from that, although it is needed more in vocational than in professional education, since professional education is generally part of an integrated system of higher education. So critics of vocational education should be confronted with the vision expressed by the UN Declaration of Human Rights. If policies and practices from the past regarding vocational, and maybe industrial, education cast shadows over present systems of preparing adolescents for society in general and the labour market in particular, it is time to remember article 26 and see pride in occupations of graduates from vocational education, their professional identity, sufficient flexibility, and ample career and development opportunities. Development opportunities can be strengthened by creating continuous learning pathways for all students and removing barriers between secondary vocational and higher professional education, validation of competence based on learning results achieved during work experience and facilitating continuing professional development, not only by formal education programmes but also by informal and non-formal learning trajectories, all of which will be discussed in other chapters in this volume.

What then is the difference between competence-based and competence-oriented education? This distinction is similar to that between problem-based and problem-oriented education. If education is oriented towards something else, such as competence or problems, then there is a loose relation between education and competence or problems. Competence or problem-solving is then the dot on the horizon which is the navigating destination. The way in which competence is being achieved can differ significantly and is not operationalised.

However, competence-based education goes a big leap further. In competence-based education, competence and competencies are the starting point of curriculum development, instructional activities and assessment practices. Occupational profiles and competence frameworks tend to define curriculum development, and from this, core occupational tasks or themes can be identified which can become the organising units within the whole curriculum. Science and social science subjects can be linked to those core tasks or themes and can be integrated in the teaching of these tasks or themes. For instance, in a study programme on food quality management, a course can be centred on a food crisis, in which epidemiology, food process design, food safety management, food law, crisis management, communication and marketing can come together. This kind of curriculum development, in which core occupational tasks or themes are identified and taken as the starting point for educational development, can lead to more authentic and holistic education, which prepares students to perform effectively in critical occupational situations and, likewise,

to a more authentic assessment. Competence-based education requires a more intensive curriculum rethinking process than competence-oriented education. The risk of employing a competence-oriented education approach is that the education programme merely pays lip service to actual professional practice, leading to graduates who are still ill-prepared for the labour market and have difficulty adding value in their jobs. This does not imply that competence-based education should narrowly focus on specified occupational profiles. That is why we speak about competence-based education and not about competency-based education. The latter is associated with a more narrow focus and specific performance related education. In competence-based vocational and professional education, sufficient attention has to be paid to complex problem-solving, creativity, entrepreneurship, interdisciplinarity, higher-order thinking skills, computational skills and mindfulness. Various chapters in this volume address these competence domains.

The title of this volume does not include the term *training*, although it is often used in the field of vocational education, like in the name of Cedefop, the European Centre for the Development of Vocational *Training* and in the title of *JVET*, the *Journal of Vocational Education and Training*. We do not object to using the term vocational training; however, we do emphasise that in this volume we have a broader conception of education and development for vocations, occupations, professions and society in general. Training (in terms of industrial training) has the connotation of being aimed at preparing students or employees for narrowly defined specific jobs of today, whereas in education (in terms of liberal education) students are being prepared for the future society and the jobs for tomorrow. Graduates of vocational and professional education may go to very different fields of work or will develop completely new products, processes or services, which may create new types of work so far unknown. So it is important to keep in mind when reading or using this volume that we advocate a broad – but labour market relevant – preparation of students for society, also because of the rather dynamic relationship between cohorts of graduates, their first employment and their later careers. Education programmes should never function as fish pods, in which graduates are trapped without an opportunity for vertical or lateral mobility in education and the labour market.

1.7 Three Waves of Competence-based Vocational and Professional Education

In the discussion about competence-based education, three different views can be distinguished (Mulder 2014): (1) competence and functional behaviourism, (2) competence and integrated occupationalism and (3) competence and situated professionalism.

These views are all connected with major pitfalls like fragmentation, performatism and holism. If in discussions, these three views are not taken into account, the discussions end up in total confusion or radical disagreement, because it is evident that critics of functionalistic and behaviouristic education will never agree with pro-

ponents of the view of integrated occupationalism since the two are based on different philosophies of education. The same holds for the difference between the views of integrated occupationalism and situated professionalism. Core thoughts in functional behaviourism are that behavioural analysis should be the foundation of curricula, that education should be composed of specifically defined small tasks and that successful task performance needs to be rewarded. Basic ideas behind the view of integrated occupationalism are that knowledge, skills and attitudes need to be addressed together in education. Knowledge transfer has always been the essence of education, which during the previous decades turned into knowledge construction in cooperative contexts as the socio-constructivist movement. But gradually it became clear that knowledge was not enough and that sound practice was needed, for which students have to master skills. Furthermore, it was said that education without personal development is undesirable, hence the emphasis on citizenship competence and social responsibility. Personal identity development should be based on knowledge and skills formation in education; the three should be linked together, which has strong implications for the design of learning tasks. These tasks should pay attention to the development of relevant skills, supporting knowledge and the connected professional attitudes in the deployment of skills, but also by which the whole vocation or profession is constituted. So this view includes the essence of professional identity development in education. Graduates from vocational and professional education should experience pride in their profession.

The notion behind competence and situated professionalism is that education has often been seen as context-free, whereas knowledge only gets meaning within a certain context, and that the meaning of competencies is context or situation specific. A good example of this is that being entrepreneurial differs a lot between a secretary of a work unit and the CEO of an international company. In education this view has led to the concept–context movement, which means that disciplinary teaching content should be linked to contextual use of that content. This so-called realistic teaching is also not without critical appraisal.

These three views are obviously pure views. In practice they will rarely be found as such. Contemporary practices of competence-based vocational and professional education comprise various mixtures of all three approaches, as will become evident in the course of this volume.

There is another fundamentally different practice or use of the competence construct. The difference is quite visible in competence frameworks that have been developed. Essentially two fundamentally different ways of operationalising competence can be distinguished:

1. Behaviour-oriented generic competence: this practice emphasises generic content- and context-free competence statements. A good example of this is the competence framework for the management profession (see Bartram 2005). Bartram reviewed studies which in total include thousands of managers, to find the relationship between competence and performance, which can be established with sufficient criterion differentiation. The result of his research is a compe-

tence framework which covers all competencies of management behaviour. The generic competencies are defined and cover a series of also defined more specific competencies.
2. Task-oriented specific competence, which does not necessarily need to be narrowly defined. A good example of this competence modelling can be found in the medical profession (Frank et al. 2005; see also the chapter of Ten Cate in this volume). This competence framework comprises generic and specific competencies, with a behavioural and content specification of what medical specialists need to be able to do. It contains task-related specifications of protocols, professional behaviour, skills and attitudes.

As seen above, we can also make a distinction between different geographic areas, such as the UK, in which the vocational qualifications approach and the skill development approach are predominant (Qualifications and Curriculum Development Agency 2010); France, which focuses on savoir, savoir-faire and savoir-être (Commission Nationale de Certification Professionelle 2010); Germany, with its focus on Beruf, Lernfelder and specified competence domains in the dual system (Deutscher Qualifikationsrahmen für Lebenslanges Lernen 2013); and the Netherlands, with a comprehensive notion of competence as the integrated set of graduate attributes of knowledge, skills and attitudes (Brockmann et al. 2011).

1.8 Questions of the Volume

In sum, theories, policies, practices and outcomes of competence-based vocational and professional education vary a lot internationally (Mulder et al. 2007b). The ambition is that this volume will provide a thorough introduction in the theory, policy, practice and outcomes of competence-based vocational and professional education.

Essential questions that will be addressed in the volume are the following:

1. What are the key drivers for the competence movement and competence-based education? (e.g. labour market needs; rapid and profound changes in work processes; permeability of vocational, professional and higher education; recognition of education-independent competence development; self-regulation of career development?)
2. What are the key dimensions by which conceptions of competence differ? What are the theoretical backgrounds and origins?
3. Are international and national policy debates on the competence-based education agenda sufficiently focused and coherent?
4. What is the value added of competence-based education for increased alignment of education and the world of work and the transition of graduates into (self-) employment?
5. What is the role of competence frameworks and standards in the redesign of vocational, professional and higher education programmes?

6. Which models for competence assessment are helpful for the measurement of student achievements in vocational, professional and higher education programmes?
7. What are distinct regional/national approaches of competence-based education and development (the UK, Continental Europe, the USA, Australasia, Africa)?
8. What is the state of research regarding competence-based vocational, professional and higher education, and what outcomes can be reported?

Many of these questions are being addressed in the various chapters in this volume. In the last chapter an attempt will be made to answer these questions and to arrive at a general conclusion regarding the state of and prospects for competence-based vocational and professional education.

1.9 Parts and Chapters

This volume consists of five parts and 50 chapters. The composition of the volume and its chapters will be introduced in this section.

1.9.1 Conceptual Foundations, Concerns and Perspectives

Part I of the volume includes chapters on various conceptual foundations of competence-based education philosophy, including chapters which express concerns regarding competence-based education and suggest alternative perspectives on education. It finalises with an integrated view on competence-based education and a theoretical view on alignment of the worlds of education and work, which is particularly important in vocational and professional education, and the overarching theme of the series in which this volume appears.

Billett starts in Chap. 2 by distinguishing three interrelated domains of knowledge that constitute competence, which he sees as broadly equated to the generation of expertise: canonical knowledge of the occupation, particular situational knowledge and the personal domain of knowledge. He elaborates the third domain, the personal domain of knowledge, analyses how personal competence domains are linked with personal learning experiences and describes the influence of personal mediation, active mimetic learning and individuals' personal epistemologies on competence development.

Vonken proceeds in Chap. 3 by reviewing the roots of competence theory and stresses that competence is a social construct. He discusses competence from the perspective of the contributions of Chomsky and White, and others. He argues that a better theoretical foundation of the construct of competence is needed, and he provides that foundation based on action theory. In doing so he goes into the relationships between types of action, performance, the situation in which this takes place and competence.

In Chap. 4, Evers and Van der Heijden explore the relationship between the concepts of competence and expertise. This relationship is often questioned as both would be fundamentally different. The authors contend that this is not the case. Coming from the field of professional expertise research, Evers and Van der Heijden mainly elaborate the notions of expertise and expertise development and stick to the expertise terminology, which does not conflict with the competence terminology. It shows that competence and expertise are highly synonymous and that the research background of authors determines to a large extent whether they tend to use competence or expertise terminology to describe, analyse and conceptualise human capabilities.

In the next series of chapters, critical views are elaborated, even to the point of arguing that competence-based vocational and professional education, professional development or the development of expertise should be based on other education philosophical foundations. These critical opinions enrich the story about the competence movement in education. Various authors have been warning for the problems which they saw as being inherent to competence-driven education approaches, many of which are cited in the chapters in this section.

In Chap. 5, Cairns and Malloch write that the term competence which emerged during the last decades has multiple meanings and that competence-based practices in education and learning differ. They state that the term capability became more popular, as a kind of synonym for competence. Also the plural 'capabilities' was used, both related to capacity and capacities. The definition of competence given in this chapter includes a reference to capability; there competence is seen as the capability to perform. Next the authors proceed with linking capabilities with graduate attributes. To a certain extent, competencies, capabilities and graduate attributes are equivalent concepts. But as said, the review of the capabilities movement enriches the debate on competence. The chapter is concluded with an explanation of the nature of twenty-first-century learners who need agility to cope with a world in which change continues to accelerate.

In Chap. 6, Bagnall and Hodge advocate an alternative epistemology for the development of vocational and professional education, being progressivism, based on the constructivist epistemology. In this chapter they broaden the theoretical perspectives on competence by distinguishing four competence-based approaches: disciplinary, constructivist, emancipatory and instrumental, which in their view are based on competing instrumental epistemologies. The result leads to quite different views on the understanding of competence, competence development, learning, the purpose of competence development for human well-being, education and assessment. The fact that conceptions of competence are rooted in competing paradigms implies that there are fundamentally different views on its worth. Bagnall and Hodge state that the appeal of competence-based approaches of education and development is caused by the current global emphasis on performance-based education and assessment, which is criticised by many who have significant objections against this dominant view on education. Bagnall and Hodge do not believe in hybrid conceptualisations of competence, in which instrumental interpretations of competence are linked with conceptions from noninstrumental epistemologies.

In Chap. 7, Hyland criticises the competence-based education philosophy in a fundamental way. He advocates the original inclusive notion of Buddhist mindfulness (and not the superficial and commercialised version of that, which he calls 'McMindfulness') as the foundation of any vocational and professional education programme and would like to see principles of mindfulness implemented in workplaces. For him, the distinction made in this chapter between various conceptualisations of competence is irrelevant, as it still is competence. As long as there are 'prespecified statements to be assessed by performance criteria with the aim of achieving competence outcomes, then it is a paradigm case of a CBET system' (personal communication), and therefore Hyland rejects any form of competence-based vocational and professional education.

In Chap. 8, Day extends the critical view on competence-based education to teacher professional development. He argues that competence in itself is an 'essential characteristic' of teachers and that it represents only a baseline level of professional expertise. This reflects the theory of expertise development as proposed by various authors, in which competence is seen as the minimum level of professional expertise, whilst there are several next levels of expertise which are needed for meaningful professional practice. Day's concern is that there is too much policy emphasis on measuring and comparing narrowly defined educational achievement, national qualification frameworks and standards for teachers, testing and evaluation of effectiveness in terms of value added. In essence, he suggests that competence should not be the dominant aim of education nor should it be conceptualised too narrowly. This also holds for teacher professional development.

In Chap. 9 Avis follows this with a critical societal analysis of cognitive capitalism. He addresses competence in relation to workplace learning, the pedagogy of vocational education, knowledge and transformation. He places the discussion about competence-based vocational and professional education, and the conceptualisation thereof, in a wider historical and socio-economic context, which is characterised by fundamental change: many traditional certainties have disappeared, and new inequalities have come to the fore, especially in societies in which neo-liberal politics dominate. He suggests that disciplinary knowledge together with workplace learning can empower marginalised groups by providing 'really useful knowledge'.

In Chap. 10 Hager, understanding criticisms of the concept of competence, advocates an integrated view of competence. He differentiates behaviouristic and generic understandings of competence and states that there are difficulties related to both. The integrated view on competence, as he suggests, combines key occupational tasks and the formulation of attributes which are necessary to perform these tasks. This view includes the context of the work situation. Hager specifically addresses the critical appraisal of competence-based education approaches, concluding that the integrated approach resonates well with current developments in educational and learning sciences, such as those on practice theory and complexity theory.

In Chap. 11, Mulder goes into an essential feature of competence-based vocational and professional education, which is the alignment of the worlds of work and education. This alignment typically takes place via competence frameworks for disciplines, sectors or professions. The development and enactment of these frame-

works are a political process in which various stakeholders are engaged. A competence framework therefore is always a trade-off between different interested parties, including education. The chapter also holds that competence frameworks need to be interpreted by the relevant players within the education system, based on their educational philosophy. It is suggested that the theory of strategic alignment in education is expanded with the component of competence frameworks which serve to align educational outcomes, learning processes and assessment strategies. The chapter concludes with a description of research on competence frameworks.

1.9.2 Competence-based Education as a Global Innovation

Part II of this volume addresses competence-based education as a global innovation. It consists of chapters from different parts of the world where competence-based education was invented or introduced. The series of chapters is not meant as an exhaustive account of what happens in terms of competence-based education around the world. Such an overview would require a veritable encyclopaedia, because very many countries have implemented some form of competence- or outcome-based education. Instead, the chapters serve as reviews of the literature, policies and practices in the given countries. There are chapters from four regions: North America, Europe, Asia and Africa. An account of the developments in Australia is integrated in Part I of this volume in the chapters of Cairns and Malloch and Hager.

The first two chapters are from North America, where the competence-based education movement started.

In Chap. 12, Barrick starts with the description of competence-based education in the USA. Barrick claims that competence-based education evolved during the last 100 years and that it started to take form in the 1960s. He states that the original reference to this innovation was 'competence-based' education, whereas this gradually changed into 'competency-based' education, but that there is no difference in meaning. Within the changing socio-economic context, high schools in the late nineteenth century started to prepare students for the world of work and society, and their mission became to help students to 'achieve *competence* through developing prescribed *competencies*'. In his chapter Barrick then describes the current concept and practice of competency-based education. He also notices that the actual terms of competency and competency-based education may not show up in educational legislation, but that the vision behind competency-based education still forms an integrated element of curriculum development, instruction and assessment of learning.

Building on the chapter of Barrick, Boritz and Carnaghan describe the developments on competence-based professional education in North America in more recent years, and in doing this, they take the accountancy profession as an example. The public and management accountancy professions have adopted a competence approach already in the 1990s and have developed diverse practices, both in Canada

as in the USA. Boritz and Carnaghan explain the developments of the professional associations in this field in detail and review the genesis and current state of the competence frameworks they produced. Furthermore, they compare the various competence-based approaches they distinguish based on various variables and evaluate the strengths and weaknesses of these approaches. They finalise the chapter with a comparison of the accountancy profession with other professions, especially in medicine, and suggest directions for the future.

The next chapters in this part are addressing diverse European competence approaches.

In Chap. 14, Stokes describes the development of competence-based vocational and professional education in the UK, identifying the paradigms and political traditions on which the competence movement in the UK was built. Stokes contends that these have had a major impact on management, organisation and related competence approaches which were linked with commodification, marketisation and socio-politics. The chapter is a further example that there have been various reactions to the competence movement, with heated discussions dividing opinion leaders into opposing camps. The chapter includes a case study describing the introduction of a competence framework in an organisation. The chapter then describes the implications of the analysis and potential future competence trajectories.

As a follow-up on the British developments, in Chap. 15, Evans and Kersh explore competence development in workplaces, which the authors see as necessary to establish a learning society and to provide the working population with a high level of competence. To realise this, lifelong competence development going beyond initial education and training has to be the standard. The authors see competence development as essential for a 'sustainable working life' and for the 'organisational development of workplace environments'. They regard self-sustainability, creativity and developmental competence as essential in the current societal context. Taking into account the complexity and contextual specificity of competence, the authors go into the tensions of national competence frameworks in the UK and the policies and practices regarding competence development in workplaces, which is very much related to notions of quality of work, organisational dynamics and motivation.

In Chap. 16, Weber and Achtenhagen state that competence-based vocational issues need to be understood from a national perspective. Therefore, they start the chapter with describing cornerstones of the German VET system. Next they summarise the genesis of German VET and go into the process of negotiation of goals and competence domains for VET by the German VET stakeholders, corresponding instructional consequences and former assessment shortcomings. For overcoming the pitfalls in VET, the authors introduce the governmental-driven VET-PISA feasibility study as well as studies on cross-national comparisons for overlaps in VET competence and studies on technology-based authentic assessments. Furthermore, they present the nationwide pilot 'ASCOT-Initiative' for modelling and measuring

competencies in the fields of engineering, health, care and business in VET. An example in the field of intrapreneurship education complements the chapter.

In Chap. 17, Le Deist describes the development and implementation of competence practices in France during the last 30 years. The dominant conceptualisation of competence in France includes (1) theoretical knowledge ('savoir'), (2) functional competencies (savoir-faire) and (3) social or behavioural (savoir-être) competencies. The competence movement in competence-based vocational and professional education in France is dominated by the state. Specific state-recognised qualifications are key to finding employment and making a career. This is quite different from other countries. The French use of competence models is compared with other countries in Europe and the rest of the world. Like other countries within the European Union, France is struggling with the alignment of its vocational qualifications with the European Qualifications Framework. The replacement of the logic of qualifications by a logic of competence appears to present a challenge in this context. The chapter concludes with an analysis of the meaning of competence for vocational and professional education in France.

In Chap. 18, Tūtlys and Aarna address the development and implementation of competence-based education in two Baltic states: Lithuania and Estonia. These relatively new EU member states have made an effort to implement various EU policies regarding vocational and professional education in the process of complying with EU educational cooperation policies like the Copenhagen process, which resulted in the reform of the national qualification systems. The chapter reviews the genesis of the competence movement in both states and describes the development of their National Qualifications Frameworks. It is apparent that competence was the core concept behind the curriculum reforms. The countries exhibit interesting differences in terms of competence-based education in that Lithuania has a rather centralised and state-led approach, whereas Estonia follows a more differentiated approach. The chapter also includes a linguistic analysis of the concept of competence in the concerning states.

In Chap. 19, Ronchetti addresses the introduction of competence-based education in Italy. The shift towards competence-based education is a radical change in his opinion, because the education system in Italy has long been based on the idea that transmission of knowledge is the key rather than the effective use of operationalised knowledge. The chapter states that in the Italian education policy development, major contradictions can be observed. The chapter describes the development of the Italian school system over the last 20 years, emphasising the introduction of competence-based education in vocational and professional education, in the context of wider developments in other education sectors.

The following chapters represent a number of Asian and African approaches.

In Chap. 20, Fan gives an overview of the introduction of competence-based education in China. He states that the developments in China were based on studies of Western competence theories and practices, which appeared to be quite confusing to those who studied them. As happened in the West, Chinese experts moved the

field of competence theory from behaviouristic to integrated approaches, although a preferred dichotomy in competence clusters was maintained: the differentiation between hard and soft competencies. Hard competencies relate to professional requirements, whereas soft competencies represent generic competence needed for citizenship, flexibility and career development. There seems to be a general understanding that narrow competence-based education is insufficient for preparing graduates for future society. The authors describes the '4 bodies and 4 fields' hypothesis and the model of '3 kinds of education', which are common place in the development of Chinese technical vocational education and training.

In Chap. 21, Panth and Rodriguez review the developments in competence-based training in South Asia. In their view this innovation is the leading approach in education for the development of a multi-skilled and adaptable workforce. As in the mainstream competence-based education philosophy, it is perceived of as potentially closing the gap between education and the labour market, which is not insignificant considering the expectation according to the authors that this region will cover 40 % of the total global workforce in the coming decades. It follows the developments elsewhere regarding the formulation of occupational standards and national qualifications frameworks, which is complemented with the development of quality assurance systems, as well as the implementation of competence-based vocational and professional education.

In Chap. 22, Viet reviews the development and implementation of competence-based education in Vietnam. Vietnam, as part of the ASEAN Economic Community (AEC), which has adopted the ASEAN Qualifications Reference Framework (AQRF) in 2015, is following the international policy developments in vocational and professional education. Part of this is the introduction of competence-based and outcome-based vocational education. The author states that Vietnam struggled with similar issues as Western countries did. He suggests various areas of development to proceed with the improvement of the implementation of competence-based education in Vietnam regarding outcome-based curricula, modules based on competence standards and performance and assessment tools.

In Chap. 23, Van Halsema writes about the introduction of competence-based vocational education, in Africa most often referred to as technical vocational education, or TVET, in Rwanda. He states that many African countries see the development of TVET as a way to realise economic growth. The main reason for choosing a competence-based strategy in the development of TVET is the putative contribution to the alignment of education and the world of work. The country of Rwanda is chosen as an exemplar of African countries wishing to improve vocational and professional education. Four years of experience with the process of setting up a system of competence-based TVET within the framework of national workforce planning has shown that this is no easy process. 'Transitional noise', as the author states, has hindered the implementation process. However, there are also signs that practical learning and creativity in TVET have improved. Van Halsema concludes the chapter with recommendations for governmental policies regarding decentralisation of TVET development and diversification in the employment strategy.

1.9.3 Competence and Key Aspects of Education Systems

Part III contains chapters about various aspects of education systems. This part starts with chapters on generic competence frameworks for competence-based education.

In Chap. 24, Perrenet, Borghuis, Meijers and Van Overveld explain their model of Academic Competencies and Quality Assurance (called the ACQA framework) which was originally developed at the Eindhoven University of Technology in the Netherlands (Meijers et al. 2004). The model comprises seven competence domains and four academic thinking and acting dimensions. Every competence domain comprises a number of competencies whereby a distinction is made between the bachelor and master phase of academic programmes. The authors describe the application of the model for various educational purposes, such as the comparison of intended programme results to learning results of students, and the evaluation of the differences between programme management policy and programme implementation. The first results of the evaluation of the model reveal that the quality of the ACQA framework is quite good in the evaluation of programme profiles.

In Chap. 25, Wesselink, Biemans, Gulikers and Mulder describe the expectations with regard to competence-based education. However, like in the chapter of Lassnigg, they observe a staggering lack of evidence of the effectiveness of competence-based education. They attribute that to the complexity and heterogeneity of this innovation, which makes that national or international effectiveness studies into competence-based vocational and professional education are enormously difficult if not impossible. They emphasise that it is necessary to take the design of the curriculum, teaching, learning and assessment into account when trying to find out if competence-based education works. They suggest to consider summative assessment, to identify related practical learning situations, to formulate relevant personal learning questions, to compose corresponding learning activities and materials, and to put these together in a personal learning environment, when designing competence-based vocational and professional education, and to take these steps into account when evaluating this education in practice. They illustrate this with examples from the green education sector and inspiring learning environments for entrepreneurial learning.

In Chap. 26, De Jong, Corten and De Jong describe the development of a laddering competence framework (called '4Cyourway') which is meant to give insight in the consecutive stages of competence development. Since generic competence statements derived from behaviour-related competency frameworks (such as of Bartram) can be applied at different levels of vocational and professional education, the question is what meaning is imputed to those statements at these levels. For example, analysis competence means quite different things at preparatory secondary vocational education compared to higher education. The authors give three examples of studies in which the framework is applied as a diagnostic instrument for student perceptions of their own level of competence. The studies show that the

framework can be used as an instrument to determine the development level of competence. A description of an example of a practical application, its impact and the usefulness of the framework complement the chapter.

The following chapters in this part of the volume concentrate on recognition, assessment, quality management and effectiveness.

In Chap. 27, Bohlinger reviews the literature and developments in the field of the validation of competence development, or in her terms, the recognition of prior learning (RPL). RPL comprises the identification, assessment and recognition of competence which a learner acquired. Competence acquisition can be realised in a wide range of learning situations, and RPL typically looks at competence gained in informal and non-formal learning settings. An important feature of RPL is that it recognises competence apart from the formal education structure, which is especially important for low-skilled workers and unemployed. Experience, duties which were carried out, responsibilities which were held and the results of often a multitude of learning moments can be expressed in (parts of) formal qualifications. In most cases this is very much appreciated by the target group as a token of recognition.

In Chap. 28, Van der Vleuten, Sluijsmans and Joosten–Ten Brinke address and review the field of competence assessment as part of learner support in education. They point at the key features of recent educational innovations, the shift to outcome-based education, the inclusion of labour market relevant professional skills and generic competencies in educational programmes, and the trends towards student-centred, active and self-directed learning. Assessment has been following these trends and now includes the authentic assessment of complex competencies. The chapter differentiates between and describes three approaches of assessment: assessment *of* learning, assessment *for* learning and assessment *as* learning. The chapter concludes with an analysis of quality criteria for assessments and observes that every assessment method has its strengths and weaknesses.

In Chap. 29, Blömeke explores the quality assurance of competence assessments. The chapter forms a bridge between the previous one of Van der Vleuten et al. on competence assessment as learner support in education and the next one of Barabasch on quality management of competence-based education. Blömeke discusses the limitations of the use of classical test theory (CTT) in competence assessments in vocational and professional education, describing the applicability of generalisability theory and item response theory (IRT). A number of examples are given from the context of competence-based vocational and higher (professional) education. After summarising the problems experienced with implementing competence assessments, Blömeke shows the value of IRT and generalisability theory to monitor the quality of competence assessment in vocational and professional education.

As said, in Chap. 30, Barabasch discusses the problem of quality of VET and does this from a European policy development perspective. Since most EU member states have introduced some versions of competence-based education, assessing the quality of vocational education institutes includes the assessment of their version of competence-based vocational education. Distinguishing two ways of assessing

VET quality, through assessing educational achievement or accrediting educational institutions, the chapter elaborates on the measurement of quality of VET in general. As stated, this includes the assessment of the quality of the implementation of competence-based education. She describes and discusses the policies, procedures, rules, criteria, tools and verification instruments and mechanisms that have been developed at EU level for quality assurance of VET.

In Chap. 31, Lassnigg assesses the empirical evidence for outcomes of competence-based education envisaged by policy-makers. He does this by a review of the research literature as documented in educational databases which cover academic publications and more practical sources. The searches were generic and included not only specific competence expressions, but also terms like 'outcomes' and 'learning'. Similar to the findings of Wesselink et al., the disappointing conclusion of this exercise is that there is hardly any evidence for the effectiveness of competence-based education. Whether this is an artefact of the operationalisation of the outcomes of competence-based education or not, it seems that there is only very little attention to testing the policy assumptions that competence-based education is a worthy educational innovation. Since this conclusion is quite disturbing, the author recommends that more effort is made to prove (or falsify) the putative added value of competence-based education initiatives.

The next chapters discuss the areas of learning, knowledge and skills.

In Chap. 32, Gessler goes into the German concept of Areas of Learning (*Lernfelder*), placing this within the historical context of German VET and refining the analysis offered by Weber and Achtenhagen in Chap. 16. In response to their apparent labour market irrelevance, certain VET subjects were removed from the curriculum, and Areas of Learning were adopted instead. Areas of Learning became a structural principle of curriculum frameworks in VET in Germany, which had implications for curriculum development and revision, the organisation of VET, school–company cooperation and vocational teacher competencies. The changes resulted in the introduction of work-centred and competence-based education in the school components of VET. In the German context, competence to act is broken down in three dimensions of competence, specialised technical competence, self-competence and social competence, and in three transversal types of competence, communicative competence, methodological competence and learning competence. The chapter then focuses on the concept and design of competence-based VET and the pedagogical foundation of the Learning Fields approach.

In Chap. 33, Dietzen addresses the heated debate on the role of knowledge in competence-based education practices, identifying fundamentally different views on this, resulting from opposing theoretical and epistemic interpretations of the concept of competence. She distinguishes holistic and cognitivist views on competence, which attribute different roles to knowledge as being more embedded in practice and more tacit versus systematically acquired and explicit. Both have important consequences for the assessment of professional competence and the pedagogical implementation of competence-based vocational and professional education in terms of informal learning versus systematic subject learning. The chapter concludes by questioning whether the social-constructivist and cognitivist perspectives

can be reconciled in a single approach to competence-based vocational and professional education.

In Chap. 34, Nägele and Stalder discuss the skills domain, which is part of competence. Skills can be treated as a separate domain, as in the complex cognitive skills literature but also as an integrated component of professional competence. Either way, transferable skills are a key for effective performance in vocational and professional contexts. In the preceding chapters, many of these skills, in broader terms of competence domains, have been presented and discussed. The authors state that transferable skills development and use are strongly related to social factors such as motivation, personality characteristics, social context and circumstances. Therefore, it is sometimes difficult in practice to transfer so-called transferable skills to other situations. However, by including guidance and reflection in skills development, the transfer value may be augmented. The chapter stresses the importance of these factors in vocational and professional education.

The last chapters in this part deal with support for teachers, teaching and learning.

In Chap. 35, Runhaar addresses the double layer in competence-based education, which is the competence development of teaching teams who are responsible for the design and implementation of this innovation. She emphasises the team component of competence-based education and states that learning to teach in a competence-based education environment needs to be a team effort; hence she views this learning as team learning. In team learning, she argues experience is essential. To make competence-based education a success, team engagement is necessary. The chapter examines factors influencing team engagement in team learning processes and concludes with the observation that human resources management can systematically influence those factors and in that way stimulate team learning.

In Chap. 36, Nokelainen, Kaisvuo and Pylväs discuss the concept of self-regulation in relation to competence in workplace learning settings. The intention of the chapter is to establish the link between the ‘multifaceted and holistic approach to competence’ and self-regulation. Furthermore, the chapter shows the role of self-regulation competence in generic vocational competence development in theory and practice.

In Chap. 37, Sailer, Hense, Mandl and Klevers place competence development in a workplace learning setting, which is a fundamental part of VET, both at the pre-service and in-service phases. They stress the importance of motivation (introduced in this chapter as a major factor contributing to performance) for the actual use of competencies in practice. They contend that gamification can contribute to that motivation and thereby to competence development and actual competence gain. Examples of introducing gaming elements in work-related learning situations which can stimulate competence development, autonomy and relatedness mentioned by the authors are points, badges, leaderboards, levels or virtual rewards. The chapter goes into gamification as a means for stimulating competence and motivation. A study in the field of intralogistics is presented which shows promising results in this respect.

In Chap. 38, Noroozi and McAlister address another key domain pertinent to the support of learning in competence-based vocational and professional education contexts, which is scaffolding argumentation competence with the aid of software tools. The authors describe representational guidance tools, digital dialogue games, and micro- and macro-scripting approaches which can assist in scaffolding the acquisition of argumentation competence. This chapter furthermore goes into the conditions under which the tools and approaches can be effectively used.

1.9.4 Competence Domains

Part IV of this volume addresses a series of competence domains in which various competence studies have been conducted. These domains are (1) discipline-oriented competence domains and (2) transversal competence domains, many of which are currently called *twenty-first century skills*. Both categories of competence domains have gained much attention during the last decade. The interest in domain-specific competence modelling and measurement is initiated by decisions to implement competence-based education on a systems scale, such as in vocational and professional education in Germany, and by reflections on the importance of generic competences that cut across various disciplines and which are important as part of the graduate competence portfolio in the future.

The first chapters in this part of the volume go into discipline-oriented competence domains.

In Chap. 39, Ștefănică, Abele, Walker and Nickolaus give a review of research on professional competence in the field of technology. They describe research results on structures of competencies and proficiency scaling, and trends in competence measurement. The chapter concludes with a review of factors that predict professional competence development. Key messages in this chapter are that professional competencies are multidimensional constructs; at the end of the apprenticeship, not all participants meet the standards set; authentic simulations are a valid competence assessment method; and professional knowledge is the key predictor of problem-solving capability.

In Chap. 40, Spöttl and Musekamp investigate competence modelling and measurement of engineering mechanics, which is a subject in the study of mechanical engineering in higher education. According to them it is still difficult to assess the achievements of education in this field, because valid competence frameworks are lacking. Focusing on the knowledge domain of competence, and the cognitive performance of students, they state that for competence diagnostics a competence model and adequate test instruments are required. Their chapter proposes a competence model of engineering mechanics. This model, and the outcomes of the study they describe, can be used for teaching and assessment.

In Chap. 41, Wuttke and Seifried give a review of work done in modelling and measurement of professional competence of teachers in Germany. They found that German pre- and in-service teachers have competence shortages. The chapter also

observes past issues of lack of conceptual clarity in competence definitions which hampered the development of a successful teacher competence model and system for assessment. The chapter then goes into recent developments of modelling and measuring teacher competence in which central competence facets play a key role. Professional teacher competence is seen by the authors as a composite of professional knowledge as well as beliefs, motivation and self-regulation. In the last section, the authors present research on teacher competence modelling and measuring which shows that what pre-service teachers miss most is subject-matter knowledge and pedagogical content knowledge.

In Chap. 42, Ten Cate presents competency models which are being widely used in medical education. He defines competency-based medical education and medical competency in line with the general definitions given in this chapter, expanding the definition of competence-based education with levels of proficiency. He also stresses the individualised and time-independent character of competence-based education. Students can finalise certain parts of education as soon as they reached the prespecified level of proficiency for certain competencies. The person who has shown that he/she can perform a given task gets the right to perform that task. The author states that during the implementation of competence-based medical education, various conceptual, psychometric and practical issues arose, which have been addressed. Two key developments which address these problems are described: milestones for evaluation and monitoring and 'entrustable' professional activities which are related to the tasks within medical practice.

The next chapters in this part of the volume are concerned with transversal competence domains.

In Chap. 43, Pavlova goes into the domain of vocational and professional education for sustainable development, describing the way competencies in the green sector are integrated in this education sector in various countries in Asia. She states that it is a general belief that green competencies need to be included in the curriculum of vocational and professional education and presents a model for greening this education sector. She also contends that values and attitudes need sufficient attention in the process of preparing education and graduates for a green economy and that governments have a crucial role to play in this process. The chapter is concluded by a case study from Hong Kong.

In Chap. 44, Neubert, Lans, Mustafic, Greiff and Ederer explore the question of whether research on complex problem-solving is fruitful for vocational and professional education research and vice versa. The authors go into competence assessment issues, especially regarding procedural aspects of competence, 'wicked' problems and domain-specific knowledge, which are all relevant for complex problem-solving. The authors give examples which indicate the importance of cross-fertilisation of competence research on the one hand and complex problem-solving research on the other hand.

In Chap. 45, Harteis starts with the observation that current society asks for professional competence, which is in line with the general thinking in this volume. The chapter builds on expertise research (which is introduced in the chapter by

Evers and Van der Heijden) and sees excellence and intuition as essential characteristics of professional competence. At first Harteis explores and reviews the scientific foundations of excellence and intuition which he sees as essential elements of professional competence. Next, he goes into theories of intuition to discuss the development of intuition competence. The chapter concludes with a review of possibilities to support intuition competence development and formulating suggestions for this development in competence-based vocational and professional education.

In Chap. 46, Toutain and Fayolle go into entrepreneurship competence. Entrepreneurship is getting more and more important given the effects of neo-liberal politics and the related reliance on independence and self-managed self-responsibility. Essentially it is a competence domain for the post-welfare state. In that respect entrepreneurship, including having an entrepreneurial attitude, is a key competence for essentially all graduates. Toutain and Fayolle state that for vocational and professional education, attention should be given to entrepreneurial attitudes and behaviours, as well as for the actual start-up of enterprises. The chapter reviews entrepreneurship education in relation to entrepreneurial competence and offers a framework of reflection on competence-based entrepreneurship education. It distinguishes two sets of competencies: technical competencies and soft skills. The authors advocate entrepreneurship to become a vested competence domain in education.

In Chap. 47, Popov, Brinkman and Van Oudenhoven go into the domain of cross-cultural communication competence. In their opinion graduates need to have global competence, which means that they need to possess knowledge, skills and attitudes that will enable them to work effectively with colleagues from different cultural backgrounds. Their main question is how global competence can be developed in education by focusing on international student mobility. The chapter reviews theory and research on pedagogies for developing global competence and as such helps educators to establish education that fosters the acquisition of this important competence domain.

In Chap. 48, Seeber and Wittmann give a review of the research in the field of social competence. Social competence, as entrepreneurship and intercultural competence, is a key field for effective performance. In the context of vocational education and training, the authors find it important to see social competence as a personal capacity which enables graduates to act in accordance with requirements which evolve from work. The authors give an overview of various approaches to define social competence and the implications thereof for vocational and professional education. Next, social competence measurement and modelling are described. Distinctions are being made for jobs in sales and services, and social and health care. The chapter is concluded with a review of the research literature on social competence in vocational and professional domains, and with suggestions for further research.

In Chap. 49, Yadav, Good, Voogt and Fisser discuss the last key transversal competence domain, computational thinking. They equate computational thinking with a set of problem-solving skills which enhance analytical ability. Since computational

competence is a domain which is also relevant in primary and secondary education, the authors first address that sector. Then they discuss the relevance of this competence domain for vocational and professional education and training and underline the importance of integrating digital literacy in vocational and professional education programmes. The chapter concludes with suggestions for further research and the view that computational competence is an essential competence domain for graduates to survive in the current technological society. It also raises interest in information technology and stimulates inquiry.

1.9.5 Conclusions and Discussion

Part V, Conclusions and Discussion, comprises Chap. 50, which addresses the key questions asked in this chapter of this volume and goes into several key issues which emerge from the various parts and chapters. The overall conclusion based on the work brought together in this volume is that much has been achieved by the competence movement in vocational and professional education, but that there are many issues to be resolved. The critical analyses have to be taken seriously, not to demolish the new integrative and holistic approaches of competence development, but in line with the views expressed in the publication on dealing with the pitfalls of competence-based vocational education (Biemans et al. 2009), to take them into account as much as possible, to overcome the challenges this education innovation faces.

1.10 Purpose of This Volume

This volume is meant to clarify the manifold meanings of and approaches regarding competence-based education, to show the diversity and to explain the backgrounds of the differences so that scholars and practitioners will be better informed about this educational innovation. It should help to make the different views on competence and competence-based education transparent and to bridge the opposing positions. The volume wants to inform debates on competence-based vocational and professional education in a comprehensive way and serve as a basis for further improvement of competence-based vocational and professional education policies and practices, development of competence theory and further research. Its ultimate mission is to improve the quality of vocational and professional education for the sake of all actors involved and to contribute to the continuing development of a competent global workforce.

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Part I
Theory: Conceptual Foundations, Concerns and Perspectives

Chapter 2
Developing Domains of Occupational Competence: Workplaces and Learner Agency

Stephen Billett

2.1 Introduction

Competence is usually aligned with specific domains of activities which can be demonstrated through individuals' performances (Mulder 2014). The idea that human competence is related to particular domains of activities was emphasised and also strongly supported across three decades of research within cognitive psychology to understand what comprises human expertise and expert performance in fields such as work (Ericsson 2006; Stevenson 1994). In essence, what was found was that human performance whilst having some levels of generalisability (i.e. cleverness or ability to manipulate knowledge) is associated with abilities for performing effectively within particular domains of activities (Chi et al. 1982; Ericsson and Smith 1991; Glaser 1984; Lajoie 2009). For instance, the particular domain-specific skills, heuristics, organisation of knowledge and solution strategies were identified as being essential by expert chess players (Charness 1989). However, when, experimentally, the rules of chess were changed, expert chess players performed no better than novices (Wagner and Sternberg 1986). So, although games like chess are often associated with general capacities (i.e. ability to plan, think and act logically), performance was found to be related to the specific practices of chess playing, not general cleverness (i.e. the ability to manipulate what is known).

However, an emphasis on domains of activity is not restricted to cognitive psychological accounts of expertise. The socio-culturalist (Scribner 1984) refers to work activities as being sets of cultural practices 'involving socially organised domains of knowledge and technologies, including symbol systems' (p.13). Rogoff (1990), another social-culturalist, also refers to apprenticeship learning as being associated with particular domains of knowledge. Indeed, those concerned with

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developing specific capacities also refer to particular domains, such as when considering the learning within and for particular circumstances of practice (Brown et al. 1989), the learning of problem-solving skills in mathematics (Renkle 2002; Sweller 1989) and literacy (Sticht 1987). The same goes for those concerned with promoting effective learning through cognitive apprenticeships (Collins et al. 1989; Lajoie 2009), reciprocal teaching and learning (Palinscar and Brown 1984), worked examples (Renkle 2002) and other instructional processes (Schmidt and Rikers 2007; Sutherland 2002). More specifically, those who have focused on the development of occupational capacities similarly refer to learning domain-specific knowledge (e.g. Gott 1989; Groen and Patel 1988).

These perspectives are particularly helpful when considering occupational practices and what comprises competent performance at work. Occupational practices comprise quite specific sets of activities that have developed across human history arising from human, cultural and societal need (Scribner 1985b). Moreover, these practices have been delineated on the basis of their esteem, standing and practicalities associated with their enactment (Billett 2014c). As such, they represent particular sets of understandings, procedures and dispositional qualities (i.e. values associated with their enactment). Hence, occupations are usually identified as a specific field of activity that have particular societal and personal standing (Higgins 2005; Rehm 1990). The social connotations include identifiable occupations and occupational communities. Personal connotations include individuals' vocations that are held arise through association with particular occupations (Rehm 1989), that is, the degree by which individuals come to identify with the occupation they practise (Dewey 1916). Hence, whereas occupations are generated as an institutional fact (i.e. that of society) (Searle 1995), individuals have to assent to that occupation becoming their vocation (Higgins 2005). What these two distinct connotations suggest is that occupational competence needs to be considered on both the societal or social plane, and also the personal one, all of which extends to the formation of that knowledge.

It is proposed here that domains of occupational knowledge comprise at least three kinds. Firstly, there is the canonical domain of knowledge that exists as a societally generated entity. This is the collection of concepts, procedures and dispositions that capture what societies want from that occupation and what are demanded and expected from those practising occupation. In earlier times, as noted, occupations were delineated and valued in hierarchical ways. In contemporary times, this domain of knowledge is often captured in professional standards documents and prescriptions for developing occupational capacities (e.g. curriculum documents). These prescriptions are, in turn, used as bases for assessing those who would practise or are practising that profession.

Second is the situated domain of professional knowledge that includes how performance in professional practice is manifested in particular circumstances (i.e. workplaces, communities, etc.) (Gherardi 2009; Lave and Wenger 1991). Whereas the canonical domain of occupations exists as a societal entity, it is abstracted from actual practice, as it represents societal needs and expectations and an expression of the cultural origins and practices of that occupation. Situated competence is that

which is required for the practice of that occupation in a specific work or community setting, that is, how actual performance of the occupation is manifested in a particular situation as the requirements for the effective practice are not uniform but shaped by the circumstances where they will be practised and judged. Indeed, competence as expertise is manifested and enacted and can only be assessed situationally (Billett 2001; Tigelaar and van der Vleuten 2014). It is on these situational bases that comprise domains of occupational competence that judgements are made about individuals' performance. Hence, it is proposed that there is no such thing as occupational expertise per se, but only when the performance in particular circumstances equates to what is taken as expertise, that is, the ability to respond to routine and nonroutine problems within the domain (Stevenson 1994). No amount of credentials and certification can compensate for the inability to perform competently in specific situations and in tasks manifested in that situation.

Third is the personal domain of occupational knowledge that individuals construct and use within and across specific instances of their professional practice as they encounter and respond to it (Billett 2009b; Greeno 1989). Ultimately, expert performance comprises a set of personal capacities and qualities individuals have developed through engagement with the domain-specific knowledge of that occupation, often in particular circumstances (Ericsson 2006). Hence, performing effectively in responding to occupational tasks they encounter and electing to engage their effort and agency in exercising that competence and maintaining it as circumstances and work requirements change are all premised on individuals personal domains of knowledge. So, it is this personal domain of occupational knowledge that needs to be accounted for, elaborated and included in considerations for what comprises competent occupational performance and how it is developed through educational provisions and workplace experiences.

Whereas the first two mentioned domains inform goals for what needs to be learnt and how the learning might best arise for competent performance, the personal domain is the central focus of individuals' constructive efforts and those that underpin both learning and performance in educational and workplace settings. This personal domain of occupational knowledge, albeit linked to the other two levels is the central concern of this chapter, that is to give due consideration to how individuals come to develop their expertise including how they mediate what is experienced and develop their personal domains of occupational competence through experiences in educational institutions and practice settings. So, although currently much attention is given to the canonical through efforts to identify national standards, statements of professional competence, national curriculum provisions, etc., there is also a need to bring to centre stage both the situational requirements for performance (i.e. situated domains) and also, ultimately, the fact that competence is something individuals come to learn, exercise and sustain. Hence, without a consideration of both situational (Billett 2001; Greeno 1989) and the personal dimensions of competence (Billett 2009b), efforts to promote that competence will be ill-placed and incomplete. In making this case, the chapter first elaborates these three domains of competence and processes underpinning their construction. The first two are essentially institutional facts (i.e. those arising from social institutions) (Searle 1995),

whereas the latter comprises personal facts (i.e. those arising from personal interest, capacities and processes) (Billett 2009b). So, whilst outlining the canonical and the situational, particular emphasis is given here to occupational competence being a personal domain.

Drawing upon examples of professionals at work identified in earlier studies, this chapter elaborates this case. It commences with a discussion of the three levels of domains of professional knowledge and how these are rendered distinct. Then, the consideration of the centrality of personal domains of professional competence is advanced and key concepts explained and illustrated. Then, the central role of personal domains of knowledge and how they are generated and their role on how the personal mediation of knowledge and its construction shape these domains of knowledge are advanced. The chapter concludes with some considerations for practice, that is, how such a domain of knowledge might best be supported through actions and interactions within educational and practice settings.

2.2 Domains of Occupational Competence

Following from above, this section elaborates these three domains of occupational knowledge as (i) canonical, (ii) situational and (iii) personal through a process of description, illustration and argumentation.

2.2.1 Canonical Domain of Occupational Knowledge

Occupations arise from and are transformed and their existence is dictated by the way they meet changing societal needs. As such, they are what Searle (1995) refers to as institutional facts. They exist because of and are exercised through human institutions (i.e. societies). Some are long-standing, such as those needed for the care of humans (e.g. doctors) and the provision of food (e.g. farmers), shelter (e.g. carpenters, masons and builders), human needs (e.g. hairdressers) and the need for orderly society (e.g. police, lawyers and judges). Yet, all occupations are subject to societal imperatives and their transformations, which variously see them emerge (e.g. information technologists, radiologists), become displaced (e.g. masons, fletchers, coopers) or change radically as needs and technologies transform (e.g. printers, clerical workers) (Billett 2011). So, occupations reflect societal needs and are subject to transformation as those needs change and transform. They comprise a dynamic set of activities premised upon occupational-specific concepts, procedures and values that are subject to change. Arising from society is the dimension of this occupational knowledge as canonical. That is, what comprises the occupation is societally constructed. For instance, there are societal expectations that doctors can diagnose sickness and make suggestions for remedies that are informed by current knowledge and careful diagnoses, and they are confidential and discreet about both

patients' sicknesses and treatments. Similarly, teachers are expected to be fair, consistent and discreet in working with and making judgements about students, as well as being able to plan and enact learning experiences, guide students' learning, provide support and make assessments of students' learning that are valid and reliable.

Occupations have always been societally delineated and valued in hierarchical ways. For instance, many occupations were deemed unworthy of freeborn men in Hellenic Greece (Lodge 1947) and imperial Rome. Then, some are seen as being of greater or lesser virtue (e.g. working for God or being a money lender) in the Middle Ages (Dawson 2005). In industrial and contemporary times, they have variously been classified as trades, paraprofessionals or professionals and attributed to particular class and status (Billett 2014c). Hence, occupations are delineated in socially ordered ways that are institutionally maintained. Moreover, they are embedded in society. Many individuals' surnames are associated with their occupations: Fletcher (i.e. arrow maker), Cooper (i.e. barrel maker), Smith (i.e. blacksmith), Miller (i.e. miller of grain), etc. Moreover, guilds, trade unions and professional associations are all institutions established to promote and advance the standing of particular occupations. Occupations are, therefore, richly embedded within society and carry societal expectations, address community needs and have bases for individuals to come to identify with and have expectations of them (Dawson 2005; Rehm 1990). Hence, they are a product of and exist as societal entities, albeit distributed in different ways across societies, and have distinct standing within particular societies. Thereby, canonical occupational knowledge comprises a societal account or expectation comprising particular sets of understandings, procedures and values.

In contemporary times, this canonical domain of occupational knowledge is often that which is presented in the form of professional standards and prescriptions for developing those capacities (i.e. curriculum documents) (Grealish 2015). These documents are used to evaluate the relative worth of that profession, the extent and kinds of preparation it deserves and the kinds of qualities required from those who would practise it (Billett 2011). These canonical accounts, consequently, have become artefacts used for the organisation, administration and appraisal of occupations. This includes decisions about the development of occupation-specific educational provisions, their enactment and means of evaluation and assessing student competence and for then to be licenced to practise (Mulder 2014). So, canonical occupational knowledge increasingly manifested as a set of ideals, goals and decision-making about their educational forms and outcomes and means for distributing access to them.

2.2.2 Situational Domain of Occupational Knowledge

However, the actual circumstances in which occupations are practised, requirements for enacting the occupation and how its enactment will be judged differ from situation to situation because the requirements for effective practice are shaped by

the circumstances in which they are practised (Billett 2001; Gherardi 2009). What the nurse or doctor does in a large metropolitan hospital can be quite distinct from those working in a regional hospital. Equally, what motor mechanics do in an inner-city dealership is different from their counterpart in a garage in a small town (Billett 1997). What pilots do when flying planes for military, crop-dusting, firefighting or passenger transport purposes comprise quite distinct conceptions of practice, how planes are flown and considerations associated with risk. Occupational performance is, therefore, manifested in a particular set of circumstances and demands for performance. Consequently, whilst the canonical domain of occupations exists as a societal entity, it is abstracted from the actual circumstances of practice, which can only be understood situationally. So, there will be particular arrays of concepts, procedures and values required for the occupational practice in specific work or community settings.

Situational requirements stand, therefore, as a particular manifestation of canonical occupational knowledge, but with particular kinds of emphases and requirements that cannot be understood at the societal level. That manifestation is in response to localised requirements including what constitutes effective performance and what kinds of routine and nonroutine problem-solving are the hallmarks of expertise (Chi et al. 1982; Ericsson 2006). It is at the situational level where what actually comprises occupational expertise is, therefore, manifested and will be adjudged (Billett 2001). Hence, there is no such thing as occupational expertise per se, but only such capacities that permit the ability to respond to domain-specific routine and nonroutine problems within such situated domains.

Ultimately, credentials and certification of the kind generated by occupational standards and national curriculum may not be adequate to capture situated performance. All this suggests that consideration of what comprises occupational competence can only be understood in terms of its enactment. Hence, occupational capacities that might be deemed effective and worthwhile in one work situation may be unhelpful and inappropriate in another. So, actions judged as being effective in one circumstance might be seen to be inept and poorly considered responses in another (Billett 2001). Consequently, beyond having and adhering to national standards and curriculum intents, there is a need to account for and address particular sets of situational requirements. Globally, the adequacy of vocational and higher education provisions is being premised on the degree by which their graduates are job ready (OECD 2010; Universities Australia 2008). If this is to occur, there is a need for greater understanding by those institutions about the diverse requirements of the workplaces in which graduates will be expected to enact their occupation and systematic efforts organised to ensure that these students are ‘job ready’ on graduation. But such expectations are particularly difficult to fulfil, not just because it is usually unknown in which workplaces graduates will find employment upon graduation, with their particular requirements for occupational practice (Kennedy et al. 2015). Hence, it may be necessary to provide a range of experiences exposing tertiary education students to different kinds of occupational and workplace requirements. In this way, the significant educational challenges that tertiary education

faces cannot be wholly guided by statements founded alone on canonical accounts of occupational knowledge. Instead, there needs to be a focus upon the situated domain of occupational competence. This also seems essential for learning those occupations.

2.2.3 Personal Domains of Occupational Knowledge

Ultimately, occupational competence is something learnt and subsequently enacted and demonstrated by individuals. It is the particular combination of what individuals know (i.e. understandings), can do (i.e. procedural capacities) and value (i.e. dispositions) that comprises their personal domain of occupational knowledge. That domain is a product of what individuals have constructed through experiences across their life histories (Billett 2009b; Gergen 1994) and will always be, by degree, person-dependent (Valsiner 2000). What individuals construct from what they experience will not be a mere replica of the textbook read or procedures modelled by more experienced workers, which are then faithfully appropriated by learners. Instead, these domains are the inevitable legacy of their particular experiences and processes of experiencing, including the work-related activities they engage with and the kinds of interactions they have with others (Billett 2003; Hodkinson et al. 2004). So, ultimately, expert performance is a personal characteristic in so far as it is premised upon the development of personal domains of occupational-specific knowledge. The character of those domains shapes how individuals' competence and preferences are deployed in and extended through responding to occupational tasks they encounter and elect to engage their effort and agency in exercising that competence.

For instance, in a study of hairdressers, it was evident that apprentices had diverse experiences to become hairdressers. These differences shaped not only their views of what constituted hairdressing but also how they practised that occupation (Billett 2003). For example, one apprentice worked for a hairdresser who had difficulty in discerning colour shades (i.e. colour blindness). So, far earlier in her career than was the case for the others, this apprentice needed to develop the ability to colour hair and it became a part of her preferences and expertise and also how she saw herself as a hairdresser. To take another example, one hairdresser had had an allergic reaction to one of the chemicals used to shape client's hair. Such was his reaction that he ceased using that kind of treatment which he saw as being toxic and dangerous for clients and himself and bad for the environment. Consequently, his repertoire of hairdressing procedures and options avoided the use of perming solutions to shape hair. One apprentice worked in a hairdressing salon where style and contemporary fashion was paramount for an inner-city clientele. Hence, the focus for her practice was based around such haircuts and also developing her own clientele. Another apprentice worked in a hairdressing salon where the style of hairdressing was conservative and acceptable in a small rural township. A third apprentice

worked in a hairdressing salon in which she was the only permanent employee and a feature of this salon was dealing with clients who would return to the salon and complain about their haircuts. Hence, this novice hairdresser developed strategies to manage both the senior hairdressers and also to negotiate with clients who would habitually complain about their haircuts. The evidence from across these hairdressers' responses to a set of standard hairdressing problems was that the particular experiences they had shaped their responses to those problems and that personal preferences, competence and values were evident, albeit in relation to the situational requirements (i.e. 'what we do here is …') of the hairdressing salon (Billett 2003).

The important point here is that the personal domains of occupational knowledge constructed by these apprentices were not uniform. They were shaped by their particular array and kinds of experiences (i.e. their ontogenetic development) and also the circumstances in which they practised hairdressing and also their preferences (Billett 2003). Yet, more than situational factors, there were particular qualities that apprentices and hairdressers brought to the task of hairdressing. Each had their own ways of identifying hairdressing goals, preferences for particular procedures and treatments and premises about how they practised hairdressing. So, there was also individual mediation of what was being encountered that led to particular kinds of learning that shaped what and how they went about practising hairdressing (Billett 2014a). Yet, these hairdressers' personal domains of occupational knowledge were not just the sum of a set of experiences; they also comprise how they had come to mediate those experiences across life histories. Should, for instance, workers, such as the hairdressers in that study, not believe that particular practice is worthwhile, good for the client, fashionable, etc., they may not seek engagement with it and include it in their repertoire of preferred procedures. So, individuals' personal domains of occupational knowledge are not just versions of canonical or situational occupational knowledge; it is also underpinned by personal factors, including histories (Billett 2009b). This is not to suggest that these individuals' personal domains of knowledge are highly idiosyncratic and are incomprehensible to others. However, it would be wrong to believe that the process of individuals at auction of occupational knowledge is merely a process of transmission leading to a common set of subjectivities. Instead, it is something constructed by individuals based iteratively on what they know, can do and value and how this is continually reshaped by their particular experiences.

So, this personal dimension of occupational domain-specific knowledge needs to be included in considerations of competent occupational performance and how it might be developed through educational provisions and workplace experiences. It is, therefore, necessary to account for dimensions or domains of knowledge associated with the following:

Canonical occupational knowledge
Situational requirements for the effective performance of that occupation
Individual's personal domain of occupational knowledge

The first two are institutional facts (Searle 1995) and can be seen as being the objects for educational and other efforts associated with becoming occupationally competent. As noted, much of current considerations of vocational and higher education curriculum are directed towards national provisions, standards and documents that often reflect occupational canonical knowledge (Billett 2011). However, these considerations tend to exclude or ignore the variations that comprise the situational requirements for occupational performance. Consequently, the consideration of situational factors is necessary because these are the circumstances in which individuals (i) need to apply their knowledge in undertaking work tasks, (ii) are judged as being competent or not, (iii) move smoothly into upon graduation from educational programmes and (iv) then come to learn more about and develop further their occupational competence across lengthening working lives (Billett 2001). Then, there is the salience of individuals' domains of occupational competence that brings together these elements in person-dependent ways as just discussed. Hence, considerations of securing and sustaining occupational competence need to account for how these arise through individuals' activities and interactions. This focus then becomes the key emphasis of the remainder of this chapter.

2.3 Constituting and Securing Personal Domains of Occupational Competence

Individuals' construction of personal domains of occupational knowledge is central to what constitutes competent performance and how that can be adapted to changing circumstances and sustained across working lives (Gergen 1994). All of this emphasises learning and development processes centred on individuals, with the goals for these processes being shaped by the canonical and situational requirements for occupational performance. In the following sections, the generation of personal domains of knowledge that arises is discussed first. Emphasised here is the personal mediation of knowledge, which is often underplayed or ignored in contemporary accounts of learning (Billett 2014a). Then, the role played by individuals' mimetic learning processes is emphasised to understand how the domain of individuals' occupational knowledge is central to their learning and development (Billett 2014b). Underpinning these activities are individuals' personal epistemologies. These include how they construe, construct and direct their energy and intentionality in processes of learning and promoting ongoing development (Malle et al. 2001). This account emphasises the person as a constructor of what is experienced and meaning maker from that process of experiencing. So, whilst in recent times much has been made of the social contributions to knowledge and knowing, including its mediation and the importance of social suggestion, norms and practices, the emphasis here is on how individuals come to interact with these suggestions and construct what they know, can do and value in person-dependent ways.

2.3.1 The Generation of Personal Domains of Knowledge

There are two broad perspectives on how human learning and development proceeds: the nativist and the empiricist (Gardner 2004). The nativist view is founded on precepts of humans being born with a range of capacities that are the foundations for their ongoing learning and development (Barsalou 2005; Chomsky 1966; Silvén 2002). The empiricist account is that individuals learn everything through processes of experiencing (Bruner 2001; Vosniadou et al. 2002). Central to empiricist and most constructivist accounts is that human's learning is an active process of experiencing and responding to what is experienced with legacies arising from what is referred to as learning. So, rather than simply being a process of accepting what is experienced, the active process of experiencing includes how the individual construes (i.e. make sense of) and constructs (i.e. appropriates) what has been experienced. That is, the process of construction is bidirectional (Lawrence and Valsiner 1993; Rogoff 1995; Valsiner 1994) or relationally interdependent (Billett 2006; Gergen 1994), rather than being a one-way transmission of knowledge from sources outside of individuals. Such claims may seem obvious and orthodox, but much of contemporary theorising gives particular emphasis to social contributions to knowledge and sometimes positions these as being non-problematic. Taking up that knowledge by individuals is often seen as being a process akin to the unproblematic transmission of knowledge, rather than negotiated (Lawrence and Valsiner 1993). In such a scenario, the domain of occupational knowledge that individuals develop and deploy would be a mere replica of what is suggested to them through observation and the social norms forms and practices with which they engage. It is as if the knowledge is merely transmitted and accepted by individuals. However, contradictorily, the evidence suggests that individuals mediate what they experienced by what individuals already know, can do and value (Billett 2003, 2009a). The nativist perspective also provides a basis to consider domains as it is claimed that humans are born with categorical orderings and structures for developing language and numeracy. In these ways, albeit in a more general sense, domains play out in this developmental perspective, as a means for mediating what is subsequently experienced and from which individuals learn.

2.3.2 Personal Mediation of Meaning: Learning and Development

Individuals' mediation of knowledge – that is how it is experienced and negotiated with – is central to their learning and development (Billett 2014a). Individuals' learning and development are separate, yet interdependent processes. Learning is something arising in the immediacy of the experience or one that is being recalled and considered. It occurs continuously as micro-genesis – the moment-by-moment process of engaging with (Rogoff 1990; Scribner 1985b) and making sense of what

is experienced (Valsiner 2000). That is, – experiencing – how individuals construe and construct what from what they experience. Development is the accumulation of those legacies that have arisen incrementally across individuals' life histories (i.e. ontogenetically) (Scribner 1985b) through micro-genesis (Rogoff 1990). These two processes are, however, separate and distinct because ontogenetic development, in turn, shapes that moment-by-moment learning. When we experience something, how we engage with what we are experiencing and change as a result of what is experienced (i.e. our construal and construction) are premised upon what we have experienced previously (i.e. pre-mediately) and come to construct what we know, do and value from that and what we have known from before (Valsiner and van der Veer 2000). So, in this way, learning is the immediate response to what is experienced – experiencing, whereas development contributes to and is reshaped by the responses to that immediate experience.

The ongoing development across life is referred to as ontogenetic development or ontogeny. It is individuals' ontogenetic development (i.e. that arising through particular personal histories) (Scribner 1985b) that mediates what they experience, construe and construct. For instance, the degree by which each experience is novel or familiar to individuals is shaped by their ontogenies. The 'same' experience will be construed and constructed in person-particular ways by individuals depending upon what they know, can do and value. In this way, the mediation of what is experienced is strongly aligned to micro-genetic development, whereas ontogeny shapes that actual mimetic process (Billett 2003).

So, whilst much of the knowledge individuals need to learn for practising their selected occupation arises through norms, practices and forms as manifested in history and culture and shaped by situational factors, individuals' personal domains of knowledge are premised upon the ontogenetic development. Consequently, although this knowledge needs to be accessed by individuals through engagement with the social world beyond them, it is constructed inter-psychologically (i.e. between individuals and the social and physical world), and mediation plays a key role in that construction.

Certainly, how individuals come to know, use and extend their occupational knowledge is subject, in part, to the suggestion of the activities and interactions in which they engage in educational settings and workplaces. These suggestions include the support of social partners (e.g. teachers, other students, workers, workplace experts, supervisors) and extend to access to norms, practices and artefacts that are central to the performance of occupational practice and how it is enacted in particular instances of practice (e.g. workplace). So these suggestions comprise opportunities to experience, mediate and construct knowledge from what is afforded inter-psychologically. Indeed, the suggestions of the social world are currently popular, privileged and, potentially, overly emphasised within contemporary accounts of learning, such as communities of practice (Lave and Wenger 1991), activity systems (Engestrom 1999), practice of communities (Gherardi 2009) and socio-material perspectives (Barad 2003). Within Vygotskian-inspired social constructivism, for instance, the term mediation is used to describe how societally generated suggestions and forms of support (i.e. social norms, forms and practices)

comprise the mediums (i.e. meditational means) through which socially generated knowledge is rendered accessible to and taken up or appropriated by individuals (Wertsch 1993). Yet, despite the essential qualities and salience of these social contributions, including mediums through which occupational knowledge is suggested (i.e. norms, forms and practices), they tend to be overtly privileged in two ways. These are blind to the importance of natural or brute factors which seem not to be accommodated within social theoretical accounts, and similarly, the mediation of knowledge is inevitably shaped by person-dependent factors.

Brute factors also influence how individuals come to construe and construct their domains of knowledge. These exist both within and beyond the person, just like societal ones. The human sensory, neural and cognitive systems mediate what we experience (Barsalou 2005; Damasio 2010; Iacoboni 2005; Iacoboni et al. 1999), and these likely change over time for humans through the inevitable brute fact of ageing. A way of working which might seem a possibility for a younger worker might well be avoided by somebody older or more experienced or undertaken in a way which doesn't require as much direct physical effort. As was the case with the hairdresser mentioned above, a physical reaction to a perming solution led to strong preferences for how he would generate goals for haircuts and go about hairdressing tasks. In this way, the physical world and how it projects its suggestions influence what individuals know, can do and value. In addition, and as proposed here, the mediation of knowledge includes how mediating factors (i.e. both brute and social) are construed, engaged with and acted upon by individuals that include their preferences, as well as sensory and cognitive capacities. Hence, individuals' domains of occupational knowledge are shaped by and enacted through both intra-mentally (i.e. within the person) and inter-mentally (i.e. between external suggestions and individuals), as Vygotsky is held to have favoured (Wertsch and Tulviste 1992), or as is referred to here, respectively, as intra-psychological and inter-psychological contributions and processes.

In all, the mediation of what is experienced is central to the generation and utilisation of personal domains of knowledge and needs to be understood through a consideration of both (i) mediating factors (i.e. brute and social) and (ii) the personal process of mediation undertaken by those who think, act and learn. These mediating factors beyond the person comprise what Searle (1995) refers to as institutional and brute facts. These facts include the contributions of history, culture, society and social institutions, such as schools and workplaces, including how they project their social suggestion to individuals through social forms, norms, practices and artefacts. Importantly, these accounts emphasise that individuals' cognition, learning and development are not restricted to what can be achieved by individuals' memory and processing capacity alone. Indeed, more than acting as an external memory and providing clues and cues for how to proceed (Lave et al. 1984), these artefacts, symbols and forms (e.g. language) constitute mediums through which human cognition is both enabled and augmented (Scribner 1985a). So these institutional factors are essential for understanding individuals' learning at and through work. However, although these suggestions are held by social constructivists as the central medium through which the social world shapes and directs human learning

and development, there is interdependence between those suggestions and how individuals mediate them. These meditational processes are held to develop individuals' capacities in ways that set humans apart as a species. Such propositions are now broadly accepted as premises for explicating human cognition and development, and deservedly so.

2.3.3 Role of Mimetic Learning

It is useful to consider mimetic learning when elaborating the personal processes of the mediation of knowledge and its relationship to the learning and development. The process of mimesis comprises the process of observation, imitation and rehearsal (Downey 2010) and constitutes innate and foundational bases for how humans construe and construct what they experience. This includes how individuals act, particularly when seeking to achieve specific goals (Meltzoff and Decety 2003) such as engaging in work-related activities and deciding the ways in which they might most effectively be enacted. Mimesis, therefore, comprises much of the everyday moment-by-moment learning (i.e. micro-genetic) processes enacted as individuals engage in their activities in work settings and elsewhere. Yet, in contemporary usage, the word imitation is often seen as being mere copying or mimicking. However, there are a number of levels and kinds of imitation (Byrne and Russon 1998; Iacoboni 2005) and that even the most seemingly lower level of innovative action actually requires higher cognitive functioning. Byrne and Russon (1998) claim that fundamentally there are two different kinds of imitation. These are, firstly, copying the organisational structure of behaviour and, secondly, copying the surface form of behaviour. With the former, the organism (i.e. individual) needs to develop hierarchical structures of actions, whereas the latter is more aligned with what is referred to as mimicry.

Whilst useful for describing the process of observation, imitation and practice, the term mimesis is, however, inadequate to comprehensively account for, describe and elaborate the development of personal domain-specific knowledge of the kind required for occupations. Regardless of whether a person is seeking to reproduce an action (i.e. the second kind of activity) or seeking to understand the underlying bases of what has been observed, higher orders of thinking are necessitated to act upon what is being experienced and remake it (Brass and Heyes 2005). These reproductions go beyond the immediate experience and mere reaction to what has been experienced. Instead, it is an active process of experiencing that draws upon a range of contributions from within and beyond the person and also one which can accommodate not only observational learning and modelling (Wolcott 1982) but the linking of observation with other sensory, neural or mental processes. So, although imagery and visual observation are key elements of mimesis, the sensory processes through which it is enacted are not limited to vision (Iacoboni 2005). Haptic qualities (i.e. those associated with touch or feel), for instance, are central to many of the procedural aspects of work performance, as are sounds (i.e. aural), not to mention smell.

Consequently, if the mediation of knowledge is restricted to observation and imitation and rehearsal, it fails to include individuals' intra-psychological processes (i.e. the internal processes of the mind and body, much of which are unobservable) (Wertsch and Tulviste 1992). Iacoboni (2005) and Iacoboni et al. (1999) go so far to suggest that the processes of enacting imitation extend beyond sensory systems and pictorial or kinaesthetic representations right to the level of neural processes. Gattis et al. (1998) also emphasise the need to explain the nature of imitative action, including the difficulty of copying an act performed from another individual's perspective and then building the complex behaviours that need to be performed for its reproduction. Consequently, the inter-psychological processes (i.e. between the person and the world beyond them) also need to be understood and accommodated for in accounts of learning. The term mimetic learning is used to capture these broad sets of contributions to how individuals' processes of thinking and acting are enacted in occupational task and come to be understood (Billett 2014b). The important point here is that these very processes of engaging with the world from which we learn but also in which we act are founded on such contributions and are what constitutes individuals' personal domains of knowledge. That is, the organisation, utilisation and exercising of those domains as well is the development over time is shaped by this broad array of factors and not just by declarative and propositional forms of knowledge (i.e. those that can be stated).

These processes of experiencing are inevitably shaped by individuals' personal domains of knowledge.

2.4 Conclusions

There are implications for the development of competence, albeit in education institutions or workplaces, about the kinds of experiences individuals have and how they are ordered, organised and enacted, arising from what has been discussed above. There are kinds of pedagogic practices that can be used to assist individuals in identifying differences between the canonical and situational and those that can potentially promote individuals' domain-specific knowledge in ways that are not limited to the circumstances in which they have experienced it. Consequently, in this concluding section, some considerations for practice that supports this learning are advanced. To advance these ideas, they are categorised in those considerations associated with curriculum and those with pedagogic practices.

Curriculum here is used in its original meaning of the course of pathways of experiences that learners progress along. Consequently, the focus is on the provisions and kind of experiences that are provided. What has been suggested above is that it is essential that the development of occupational competence require a consideration for developing both canonical and situated conceptions of occupational performance. So, curriculum considerations are necessarily associated with the provision of experiences that provide access to and engagement with what can be taken as the canonical knowledge of the particular occupation (i.e. domain of

occupational knowledge). This provision is usually realised through a combination of experiences in educational settings and workplaces which address the key kinds of learning that are required for anybody practising the particular occupation. Considerable attention is given to meeting occupational requirements in contemporary tertiary education, and these are often quite tightly regulated, that is, education institutions have to demonstrate the ways in which they address the competences required for the occupation. There are also external examinations organised by professional bodies that aim to ensure that anybody who is recognised as a practitioner in a particular occupational field can meet the requirements of that occupation. So, novice teachers are sometimes subjected to inspections of their teaching, pilots are tested in simulators and monitored by test captains in flight, and doctors and lawyers are subject to examinations by professional bodies. Hence, there are often well-established processes to identify occupational knowledge, find a range of experiences that can generate that knowledge in learners and then assess the degree by which they have learnt that knowledge before they are entitled to practice.

However, much less consideration is given to particular situational requirements of occupations and how students can develop competence in understanding something of the variations of these practices. What seems to be required is, firstly, that those preparing for an occupation are given access to experiences in different circumstances where that occupation is practised. This can assist in avoiding problems arising from novice practitioners only having experienced the occupation in one particular kind of setting. For instance, when trainee nurses were prepared in hospitals, they rotated through all the kinds of hospital wards. In this way, they came to experience something of the diversity of nursing work in general, medical, maternity, mental health and other kinds of wards such as intensive care, as well as being rotated through casualty and outpatient facilities. Through these kinds of experiences, they would come to know about and practise nursing in different ways across these wards. That is, they might come to understand how canonical knowledge of nursing is enacted across these wards. The outcome of these experiences is that nurses would come to realise there are situational variations of canonical nursing capacities, that is, what constitutes being a competent nurse differs across wards. However, rarely is it reported that explicit strategies were used to assist the trainee nurses in recognising these manifestations and also the canonical principles of nursing. All this suggests that a consideration of curriculum – the ordering, organisation and enactment of experiences – alone is insufficient. Instead, there is also a need for pedagogic practices to assist learners in developing understandings about these distinct manifestations of occupational competence.

Pedagogic practices comprise interventions by teachers and more informed others to assist individuals' learning. These practices can differ from classroom-type experiences that seek to make knowledge which would not otherwise be learnt, in practice settings, for instance, and seek to augment and extend what learners have previously experienced. In the nurses rotations described above, a need for interventions was recognised to assist the nurses to appreciate the particular kinds of goals, procedures and values associated with the ways that nursing work is conducted in each of those settings. Learners are not always best placed to identify nuances,

differences, similarities and exceptions, because they are actively engaged in constructing meaning, developing procedures and appropriating values associated with each of these instances of nursing practice. Hence, it is likely that some kinds of pedagogic interventions are required to assist these novices to appreciate the particular form of nursing required in each setting, yet also to identify the canonical concepts, procedures and values that are common and commonly practised across each of these settings. Most probably, these kinds of interventions will be most effective when they occur after the novices have had the experiences. Most helpfully and most practically is when learners are able to engage in discussions about these experiences and are being guided by a more informed partner. Students will bring and contribute their particular kinds of experiences to these processes, thereby opening up the range of experiences that are available to the learners. Yet, it is likely that such processes will need to be guided by a more experienced other who is able to assist learners in identifying particular qualities of the different kinds of instances that individuals or the cohort have experienced and thereby assist them in understanding something of the diversity of what comprises occupational competence in different kinds of circumstances where they are practised.

Also, part of those pedagogic practices is to assist learners engage effortfully in constructing meaning both within educational programmes and practice settings. For instance, it was found that there were particular roles to be undertaken by teachers and more experienced others before, during and after students have had their practicum experiences in a large-scale national teaching project (Billett 2011). Consequently, there are particular kinds of pedagogic practices that might need to occur before students or novices engaged in particular settings prepare to be active learners, because it is through those processes that they come to develop further personal domains of occupational knowledge and competence. Then, processes and interventions were suggested to enrich the kind of experiences that students have in practice settings to generate rich learning outcomes from those experiences and engage them in personal and collaborative considerations about what constitutes competence in each of the settings and how that relates to occupational performance more broadly (i.e. the situational and also the canonical). Then, at the end of those experiences, most important are the interventions associated with students coming to share and reconcile their experiences with others and in relation to what they are seeking to secure through their occupational preparation in terms of learning the canonical knowledge but also developing adaptable occupational competence. That adaptable competence is central not only to securing a smooth transition to practice on graduation and when first employed but also generating the kinds of understandings, ways of doing things and valuing which can be applied across a range of circumstances where the occupation is practised.

In conclusion, it is held that not only do we need to consider competence as constituting specific domains that comprise canonical occupational knowledge and situational requirements, but most importantly how individuals come to construct their own domain-specific occupational conceptions, procedures and values. All of this suggests that more than attempting to secure national statements and measures of occupational competence in students, novices and apprentices, there is also the

need to develop the learners' personal domains of occupational knowledge in ways that permit them to be aware of the variations of occupational practice they will encounter and have means of responding to the requirements of those situations.

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Chapter 3
Competence, Qualification and Action Theory

Matthias Vonken

3.1 Introduction

Competence is still a widely used concept to describe capabilities – mostly of employees – to perform in a certain way in organisations. Although a long and ongoing debate primarily about measuring competence and secondary about competence development exists, the concept itself is only partly founded on theories. It sometimes seems that 'competence' is used as a matter of fact, as if it were a real object like an arm or a head. Rather, it is a social construct, only viable if it is grounded on a common understanding of what it should stand for. And this common understanding seems to be still missing after a debate that lasted at least since the 1980s. What could be helpful is the offer of some theoretical framework that goes beyond what was already discussed by Chomsky, White and others. This chapter will try to formulate such a framework. Therefore, it will start with a short overview of the theory discussion of competence in the past and discuss the relationship between competence and qualification. In the second step, it will try to explain why the close relationship between competence and performance is one of the problems not only to measure competence but moreover to get to a decent understanding of competence itself. That will lead to thoughts about how to get to a theoretically founded explanation of competence. The most used way is to define a desired performance and afterwards derive a relating competence. The chapter will show why this is problematic and offers an alternative explanation of competence on the basis of action theories by analysing the relationship between action, performance, situation and competence.

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3.2 Theoretical Roots of 'Competence'

'Professionals are competent when they act responsibly and effectively according to given standards of performance. They are held to possess sufficient competence. Professional competence is seen as the generic, integrated and internalized capability to deliver sustainable effective (worthy) performance (including problem solving, realizing innovation, and creating transformation) in a certain professional domain, job, role, organisational context, and task situation' (Mulder 2014, p. 111). With this definition, Mulder summarises the majority of recent international discussions about competence. However, it also shows some of the problems included in these discussions. We will examine some of these problems later. First we will have a short look in its history. The concept of competence itself dates back to ancient times (see Mulder et al. 2007, p. 68; Vonken 2005, p. 16). In its original Latin meaning, 'competens' is translated with 'appropriate', and 'competentia' means conjunction, correspondence. Its original use was in the sense of being responsible (and able) for specific tasks. In this way it was used, e.g. for describing a jurisdiction (cf. Gauvain 1868). Even Max Weber used it in this sense (Weber 1980, p. 125). Later on, the capability aspect became more dominant. In psychology, White used 'competence' to describe the special human capacity 'to interact effectively with its environment' (White 1965, p. 11). He developed his competence concept in contrast to the drive theory of motivation. Competence in this sense means the ability to produce effective behaviour to reach goals in a given environment: 'The behavior that leads to the building up of effective grasping, handling, and letting go of objects, to take one example, is not random behavior produced by a general overflow of energy. It is directed, selective, and persistent, and it is continued not because it serves primary drive, which indeed it cannot serve until it is almost perfected, but because it satisfies an intrinsic need to deal with the environment' (White 1965, p. 15). Competence thus means the desire to manipulate the environment, to be 'effective'.

Another influential approach was made by Noam Chomsky. In his book *Aspects of the Theory of Syntax* (1990, first published 1965), he describes the human ability of creating and understanding language – a reaction to Skinner's attempt to include language and language production in his theory of behaviourism (Aebli 1980). While Skinner argues that language is a result of stimulus and reaction, Chomsky differentiates between *the production of speech*, which he calls 'performance', and the *ability of inventing and creating sentences and understanding speech acts*, the 'competence'. He argues that the diversity of human language cannot be a result of imitation but must be a creative act. Although human beings only know a limited number of sentences and grammatical rules, they are able to produce sentences they have never heard of. This creativity in combining grammatical rules into new language is the result of the linguistic competence, which is vested in every human being and is developed over a lifetime. With this explanation, Chomsky refers back to the linguistic theory of Wilhelm von Humboldt (1836), who described language as something that is constantly generated: an iterating work of mind.

Language competence in this context is understood as *a set of rules that enables people to act and react creatively* in the area of speech (see also Kraus and Vonken 2009).

Putting together these theoretical attempts and lifting Chomsky's linguistic theory to a general action theory (Aebli 1980; Baacke 1980; Geißler 1974; Habermas 1990) – this is common in the philosophy of mind, where speaking is only another form of acting; cf., e.g. Anscombe (1958) – 'competence' means the *desire* to manipulate the environment (Hersey and Blanchard 1972) and to be able to do so by having the necessary capabilities in the form of general acting rules that can be combined to situation-appropriate actions. More generally spoken, this should show a 'capability to deliver sustainable effective (worthy) performance' (Mulder 2014, p. 111).

These are actually the main routes of theory in the sense that they not only try to define competence for some specific reason. Instead they have a theoretical concept behind it. Many others rely (often implicitly) on these theories, e.g. McClelland (1973), who recommended a change of educational testing from intelligence to competence for predicting performance, but didn't deliver an own theory. We will not examine all the approaches because others did it very well in the past (e.g. Arnold and Schüßler 2001; Mulder et al. 2007; Velde 1999). In the given context, it is more interesting (1) why the concept is so successful and (2) what are the existing theoretical problems and drawbacks. Particularly the last shows up in the huge number of quite different definitions (not theoretical approaches) for competence.

3.3 Competence: It's All About Performance

'Competence' is a widely used labelling for a human capability, mainly desired by economy, as Velde says: 'The curriculum of this decade must provide students with the tools to function in a truly global economy' (Velde 1999, p. 437). If we look closer, we will find that it is not the capability that is desired, but a certain behaviour which is presented in the performance that should come out of competence.

The 'tools to function' changed alongside the development of economy. In the twentieth century, it was quite common in most Western countries to learn for a job in an apprenticeship or vocational college and afterwards work in this job for more or less the rest of one's life, usually in a standard employment relationship. In bigger companies, such as steelworks, for example, it was also quite common that several generations of a family were employed. This had the effect that coordinating one's working life was comparably easy: people knew where they came from and where to go. This had also the effect that the acquired qualifications were only updated from time to time, but usually not considerably changed. The updating process was mainly up to the employer or the society, depending on the cultural system somebody belonged to. These conditions changed since the end of the last century.

A new, more globalised economy and therefore a new competitive pressure caused (or were taken as reason for) a change in the way of producing goods and delivering services. While in an 'old' economic regime, a division of labour following Taylorism was predominant, this slowly changed to a more holistic condition of work, in which workers have to accomplish more complex tasks and were more taken into responsibility for the quality of work (Vonken 2005, pp. 73–98). This led to demands for new forms of skills. First, they were discussed as 'key qualifications' (see Mertens 1974). Those should enable people to rapidly adapt qualifications to changing labour markets and economical demands. The tools to function hereby switched from formal qualifications to a more subtle mix of general qualifications and aspects of one's character, such as being creative, having a desire to perform, etc. (ibid.). The introduction of key qualifications meant a change mainly in the way how work and the role of workers are to be seen. While in the past secondary qualifications like dutifulness and reliability seconded the formal qualifications, thus showing the role of a worker as someone who is mainly executing instructions, he/she gradually received more responsibility for the result of his/her work and was claimed to act more self-responsibly.

The next step was to introduce competence as the goal of vocational education and training. The difference to key qualifications is to be found in the increased inclusion of aspects of the character. Formal qualifications partly lost their significance due to a higher speed of changes in economy, and aspects of an entrepreneurial character were claimed to be necessary to cope with current demands of labour: 'One reason is the new challenges in work processes, especially the increase in types of work that require people to adapt rapidly and flexibly to changing tasks and conditions' (Salling Olesen 2013, p. 155). To be able to do so, it is claimed to be necessary to bring into work more than just qualifications. Rather, aspects of personality were brought into focus. Now it is necessary not only to be a good performer but also to develop an intrinsic motivation to perform competently (Vonken 2001). Sennett pointed to these new demands for workers when he wrote about the corrosion of character, the demand to submit one's private life to working life (Sennett 1999). The new form of worker that is needed to fulfil these demands was named 'entreployee' (Pongratz and Voß 2003).

Now, the problem arises when we try to define what the basis of 'perform competently' is, i.e. what does competence mean as a capability to perform competently. As we saw in the beginning of this chapter, 'Professionals are competent when they act responsibly and effectively according to given standards of performance. They are held to possess sufficient competence' (Mulder, op. cit.). Now, there is a meaningful distinction between acting in a specific way and possessing a capability for those actions, called competence. McClelland (1973, p. 11) described this distinction: 'To use a crude example, a psychologist might assess individual differences in the capacity to drink beer, but if he used this measure to predict actual beer consumption over time, the chances are that the relationship would be very low. How much beer a person can drink is not related closely to how much he does drink'.

Characterising an action as competent depends on the observer's point of view. Regardless if there would be standards for assessing competence, an observer can

never step out of his/her lifeworld (see part 'competent action') to make an objective assessment. This is one reason why it is not possible to judge about a competence via observing the performance, and furthermore to predict competent behaviour. Someone who watches another one's action, judges about the action in the light of his own experiences, his own attitudes and his knowledge about the situation and the circumstances in which the action was shown. Talking about competence that underlies performance implies to derive a capability from performance. In other words, an observer can only judge about what he/she sees, but he/she cannot see what is behind the shown action: 'The constituents of competence are the diversity of human attributes that underpin performances. As noted above, a key point about the constituents of competence is that, unlike performances, they cannot be precisely specified. These underpinning constituents of competence are attributes or properties of people such as capabilities, abilities, and skills, and, quite simply, precision in describing them is not attainable' (Hager 2004, p. 420). One always runs the risk to fall into the trap of halo effects and logical errors. It is therefore hard to understand why it is tried to infer something very vague (competence) from something quite clearly assessable (performance) instead of concentrating on the more clear item.

Maybe this is one cause why specifying as much detailed description of performance as possible has been tried. 'It is sometimes thought that if only they are made more and more minutely detailed they will become complete; the abstraction will be overcome. If only we can find enough suitable words to describe the taste of the wine, the detailed verbal description will match the tasting experience. In fact, because language is inadequate to capture human experience, the paradoxical result is that the more minutely we try to specify it, the more the actual experience eludes us. This is why it is always an error to (vainly) seek completeness for competency standards by proliferating descriptions of more and more minute tasks' (Hager 2004, p. 420).

The same was already identified for the discussion of key qualifications (cf. Zabeck 1991, p. 57): 'The more general or context unspecific key qualifications are defined, the more likely it is that the transfer fails (…). The narrower or per situation-specific key qualifications are taken, the further they move away from their designated function to develop efficiency, regardless of the exact specification of to be handled demands' (translation by M.V.). It shows that trying to specify a competence by describing and deriving it from the consequential performance leads to another problem: the multiplicity of competences. Particularly in the German discussion, a lot of different competences were claimed (Vonken 2001). Going back to the roots of competence, the concept of Chomsky, this would mean to have a separate system of rules for each specified competence. This is not only unlikely; in fact these systems of rules cannot be separated accurately: what are the precise differences between, e.g. social competence and self-competence, concerning the underlying systems of rules? Is it, e.g. really a different rule to act in a team and to be communicative?

Due to these reasons, it does not make sense to try to specify a huge amount of desired performances and afterwards search for underlying competences. What we

can observe is only performance: 'No doubt there have been proponents of competence who thought otherwise, but if, as I maintain, it is performance rather than human capabilities that can be sufficiently and meaningfully represented in statement form, then these proponents of competence have mixed up different categories of items, thereby committing the first pervasive error about competence. It is precisely because performance is observable/measurable/assessable (as shown in the previous section), while the capabilities, abilities and skills that constitute competence are inaccessible, that judging competence always involves inference' (Hager 2004, p. 421). If we take a look in the history of competence and in the history of work, as shown above (see also in detail Vonken 2005), we can see that indeed precisely described, fragmented performances are not in the centre of attention. Rather it is a specific kind of action that is widely judged as competent (and which is represented in the performances) as the outcome of an action. An action – in short – consists of an intention and the 'doing' (see Searle 1983). The result of observing an action is called the performance, i.e. what is done and how it is done, and this includes different qualifications and skills that specify the competent action more precisely. What has to be explained is the nature of this specific kind of action, not necessarily the varying qualifications and skills or the numerous performances. We would then avoid to specify multiple performances and can search for perhaps the one common competence which could be the basis of this competent action.

Performance is nothing else but observed acting, which is judged as competent. In the sense of Chomsky, performance is the interpretation of an actor's action by an observer including the assumption that competence is the basis of the performance. In an ideal situation, the performance would represent the competence; in reality many aspects influence the actual performance (see below). From the point of view of an observer, someone, who is acting, 'performs'. From the standpoint of the actor, it remains acting. The difference is that action includes intention and this intention is invisible for the observer. In the given context, to act competently means to cope with given situations (usually in work) in a specific way. We will stress again Mulder's description of competence from the beginning, because it summarises many discussions, to explain what makes an action competent. According to that, acting competently means to act 'responsibly and effectively' and 'to deliver sustainable effective (worthy) performance (including problem solving, realizing innovation, and creating transformation)' (ibid.). Acting competently thus means first to be self-responsible. Furthermore, to be effective it is necessary not to depend on others' advices but to act self-organised and autonomously. It seems to be clear that one cannot be made responsible for actions or be effective in acting when he/she depends on others' advices in a specific situation. Sustainable and worthy performance in the form of problem-solving adds further adjectives to the examined kind of action. For problem-solving, one has to be able to flexibly react on given circumstances of a situation. In the light of competent acting, problem-solving usually means to cope with unknown situation, which introduces a necessary portion of creativity as a further major characteristic.

3.4 Action Theory

We now have some descriptors for competent acting. They fit well with the aims for introducing competence as stated above. To adapt rapidly to changing situations surely needs an acting which includes the stated characteristics (and possibly some more). But adapting to a situation means more than that. We have to examine the dependencies between acting and situation first to understand what additionally is needed.

First, acting is intended behaviour (Davidson 2011). Acting without intention is just behaviour which can as well be accidental. Being intentional thus defines action. Furthermore, behaviour can be observed as performance; the underlying intention is invisible. An action thus never shows the intention directly. An intention for acting can exist before an action or it can be embedded in an action. The first is called 'prior intention' and the last 'intention in action' (Searle 1983). If one wants to buy a car, for example, one usually will first think about the desired specifications and afterwards build the concrete intention, what to buy. This is an example of a prior intention. However, other actions *contain* the intention, e.g. if one raises an arm. In most cases this will not happen unintentionally; on the other hand, we would not say that first one 'decided' to raise the arm. Raising the arm and having the intention to raise the arm happen in the same moment, so the intention is in the action itself. For the investigation of competent actions, it is furthermore interesting, where these intentions – which are of course part of a competent action – come from.

Intentions are not inherent. In the case of intentions in action, they originate from the situation in which an action takes place. Prior intentions come, e.g. from the actor's biography, resulting in decisions. If we think about competence as a special kind of action including specific intentions, it becomes important how these intentions arise and how they are perceived. It is obvious that competent acting means successful acting. Successful acting means that intentions are fulfilled in an action. If people want to do something, their intention is fulfilled if the result of their action meets their intention (if somebody wants to cross the street, his or her intention is fulfilled when he or she arrives on the other side, without being hit by a car). The intention is directed to a *specific* result of a specific action. An action could have other results as well which are not necessarily part of the intention, as will be shown later on. Intention is the basis for acting, but it is not causally determinative. An intended result does not follow directly an intention. There are steps in between having an intention and fulfilling this intention in an action, which can cause the failure of an action. If an intention would be causal for an action, failed actions could be led back to these intentions. We know that this is usually not the case. For competent acting to be a successful acting in specific circumstances, it is therefore important to know what can happen besides one's intention.

Intentions are not part of the process of building intentions. In other words: I cannot intend to have an intention. Intentions, on the other hand, do not come 'out of the box', they have their own history, they do not simply arise. Brandtstädter and

Greve (1999) distinguish between unintended, contra-intentional, para-intentional, peri-intentional, pre-intentional and sub-intentional aspects of an action which can influence the way of fulfilling an intention in an action and of building an intention. Unintended aspects are simply those things that happen as part of my action but were not part of my intention. They can have negative consequences but usually do not prevent my intention from being fulfilled ('collateral damage' would be an example). As an observer only sees the action and the result, I would be held responsible even for unintended aspects. This is another argument for not deriving competences from performances. Contra-intentional aspects were explicitly excluded in my intention. If they occur, something happens that I wanted to prevent. For an observer it would nevertheless part of my action and thus (for him) potentially part of my intention.

Often acting is not only fulfilling *one* intention, but in the situation of acting, several intentions are present and at the same time others are unconscious: 'If I absent-mindedly drive straight on at a traffic light, as I always do on this route, instead of – what I originally intended – turning this time (perhaps because I thought on other things or because concurring, currently not realized motives kept me from turning), then this is not by all means what I wanted to prevent, although originally I wanted to turn' (Brandtstädter and Greve 1999, p. 198, translation by M.V.). Those kinds of aspects of action are called 'para-intentional'. They exist but they are not always present in the situation of action. They are not 'unintended' in the strict sense of the word. They are to be found in connection with the 'intention in action' stated above and demonstrate that acting mostly is not in the way of having a prior intention.

Particularly in actions with prior intentions, it can happen that one knows what else could be the result of his/her action but considers it as acceptable. These aspects are called 'peri-intentional'. They are not unintended but part of the original intention in the sense that one does not intend to do them but knows that they can occur (One could argue that these peri-intentional aspects are the real 'collateral damages'.). Subintentional aspects are simply the physical aspects of each action, like contraction of muscles. They of course play an important role in each action, because if physics limits my actions the fulfilling of my intentions is in danger, but usually they are not part of intentions themselves.

The last and potentially most important category is the pre-intentional aspects. As stated above, intentions do not come out of the box. They have their own history, the history of the actor and his/her possibilities for acting in his/her biography. Many intentions and thus actions base on emotions, habits, experiences, attitudes and so on. They are results of one's very own development. That does not mean that intentions and actions are determined. However, in many action theories, the rational actor has no history, so it is worthy to consider this fact. Rather the personal biography influences the forming of intentions and thus the acting.

We now know that intentions and thus actions are influenced by many aspects, societal and biographical as well as of course physical. The next step is to understand how intentions as moments of steering actions evolve. We know where intentions

come from and that an intention is completed when the corresponding action is performed. Now, the moment that leads to the building of an intention is usually a purpose or a goal. If it is recognised, the intention will be built to achieve the goal through an action. This purpose can be external or immanent to the action. If it is external, we impute a chronological order from cognition, intention and action, i.e. first 'world' is recognised and purposes in this world are fixed (ideally independent from options of action), which leads to the building of intentions and then of actions. This view assumes that humans first have to fix such a purpose in the recognised world and then actively make a decision to pursue the purpose (i.e. the intention) before starting to act (Joas 1996). This is mostly not the case, of course. Acting in routines (like driving a car) and acting creatively (like painting a picture or rather inventing something) do not follow such a scheme. The problem is that neither the situation, in which someone is going to act, nor the options for acting are included in this scheme. The separation of 'world' and actor inherited in this view, where 'world' is something outside the cognitive individual, leads to an artificial understanding of the relation of acting and situation. It assumes that goals and purposes already exist in an external world, and the act to decide to pursue them is then willingly made, i.e. the forming of intentions would be intentional. That leads to an infinite regress. Alternatively, we can try to include the action situation itself in this calculus.

Acting always happens in situations. And situations provoke acting. If we face a situation, we reflect our action possibilities in the light of our dispositions, our habits, our own biography and our possibilities and experiences to act; in short, reflection of a situation always happens in the light of our lifeworld (Lebenswelt) (Habermas 1989). In this reflection, purposes are found and intentions are built. The process of reflecting is actually a process of constructing. It is not the 'world' in the sense of a world external to the acting subject, in which we recognise purposes; rather it is the lifeworld which contains our possibilities for acting and thus preforms the recognition of purposes and goals. This is where the intentional aspects mentioned earlier come back into the game. The lifeworld contains some of these aspects, namely, the para-intentional, peri-intentional and the pre-intentional. The purposes and goals are already part of the recognised and reflected situation in the sense that we 'construct' the situation individually against the background of our knowledge and experience and with the focus on the usability of this construction for acting (Maturana and Varela 1992). The difference between this approach and the scheme of recognising, fixing purposes and building an intention and then act is that here, the process of cognition is part of the action itself. The possibilities and limits of action shape the construction of a situation and thus the cognition. The development of an intention is then bound to the construction of an action situation and its conditions. The situation contains the purpose for action in terms of a challenge for the actor that shines up in the reflection and thus in the construction of the situation. In this sense, constructing a situation and reflecting a situation are two sides of the same coin; they are mutually dependent.

3.5 Competent Action

We saw earlier that acting competently means to act self-responsibly and self-organised and autonomously, flexibly and creatively to adapt to and to cope with unknown situations. But as we saw too, 'coping with situations' does not mean to recognise an entity, independent from the actor. It is rather a process of constructing an individual reality and interpreting it against the background of the lifeworld.

Although we consider that situations are individually constructed, we can assume that they are not exclusive to an individual, particularly those situations, in which competent action takes place. They are rather usually shared with others. It may be that a 'Robinson' on his/her lonely island acts competently in a situation that only affects him/her, but that is usually not interesting for the debate. If, on the other side, someone acts in any given societal context – even if he/she acts alone and without any direct connection to other people – then this will be in a shared situation; it affects others in some respect. Sharing a situation means that several people construct a situation individually and then try to *define together* what the special characteristics of the situation are. This definition is done in the light of their lifeworld: 'Situations do not get 'defined' in the sense of being sharply delimited. They always have a horizon that shifts with the theme. A *situation* is a segment of *lifeworld contexts of relevance* [*Verweisungszusammenhänge*] that is thrown into relief by themes' (Habermas 1989, pp. 122–123) (('Context of relevance' seems not to be a proper translation (although it is an 'official' translation of Habermas' work) of the very often used but also very difficult German term 'Verweisungszusammenhang'. The term is originated by Heidegger; the translation of *Being and Time* is 'referential context'. For further explanations, see below). If these definitions fit to a certain degree, a common situation is born, in which intentions are found and actions take place.

In the context of work, those situations usually are located in some kind of organisation. Organisation has a lot of definitions (see, e.g. Etzioni 1964); we will use for our purposes a system-theoretical approach (Baecker 1999; Luhmann 2000). In this view, organisation is a social system which consists of communication about and of decisions. This communication can happen top-down or bottom-up, but its purpose is always to reduce the complexity of the system. If the complexity of a system is not reduced, it will grow over time and then collapse (I will not go further into the details of system theory here; see instead Luhmann (1999a, b) and Luhmann and Barrett (2012, 2013)). A situation, in which a potentially competent action takes place, is in this context a situation which tends to increase complexity in the organisation. It is necessary to reduce this complexity by communicating decisions, i.e. by defining the situation, 'building' an intention how to solve it and acting accordingly. By acting to manage the situation, we implicitly or explicitly communicate our decision how we are going to reduce the complexity brought into the organisation by the situation. If the complexity is reduced, we can say that the situation is successfully managed, and we would state the corresponding action as 'competent action'. This competent action will be characterised by the control of the intentional

aspects (particularly the contra-, para-, peri- and to some extend pre-intentional aspects) and by the fact that it was self-responsible, self-organised, autonomous, flexible and creative. A short example will illustrate what is meant.

A customer brings back a coat to a store. She wants to return it and get the money back. She states as the reason that she bought the wrong colour. The clerk inspects the coat and discovers that it has a stain. She (the clerk) now has several possibilities how to define the situation and how to act:

(a) She calls her boss.
(b) She accepts the return and reimburses the money.
(c) She refuses the return in general (like in a 'no-return policy').
(d) She refuses the return because of the stain (coat is 'used').

In these possibilities, we can see different definitions of the situation by the clerk. In (a) she could perhaps be overstrained or feel uncertain. She decides not to decide. This decision will increase the complexity of the organisation because her supervisor now will be involved too. It shows that giving away responsibility, not trying to act autonomously, flexibly and creatively, can increase complexity and usually won't reduce it (besides perhaps in bureaucratic organisations). We would usually not call it a competent action. In (b) she simply ignores the consequences of their decision and action. If, e.g. it becomes generally known that it is possible to return used clothes to this store without problems, it could lead to unwanted effects for the organisation that would also increase the complexity. In terms of intentional aspects, she does not pay attention to the contra-, para- and particularly peri-intentional aspects of her action.

Case (c) is similar to (b), just the other way round. The apodictic refusal seems to reduce the complexity of her organisation at first glance, because it is self-responsible and autonomous albeit not flexible and creative. On a closer look, we can say that particularly the peri-intentional aspects didn't get attention. Customer retention or service orientation possesses high significance in today's economy, so a simple no-return policy could drive away customers. In the end, this would increase the complexity of the organisation too. We wouldn't judge it as a competent action. Finally, (d) differs from (c) by giving a concrete cause for the refusal. However, in contrast to (a) to (c), it contains an implicit offer to the customer to join a discourse. The customer could explain the stain, both could think about solutions of the problem, etc. If they find a solution satisfying for both parties (e.g. the customer has the coat cleaned before returning it), the complexity of the organisation would be reduced. The action has all the attributes stated above; particularly the peri- and contra-intentional aspects were considered, and it is self-responsible, creative, etc.

If we would stop here, we would have added only another description of performance and named it 'competent action'. However, the competent action is not to be characterised by attributes, as we argued above, because it would then be dependent on others and on different contexts. The customer, for example, could assess the situation in (b) as competent, from his point of view. What makes the action in (d) a competent action rather is that the clerk and the customer agree on the definition of

the situation and to corresponding actions. That is what in the end solves the problem and helps to manage the situation successfully. The reduction of complexity is an outcome. The (alleged) awareness of the intentional aspects is one precondition for the definition of the situation. The characteristics of the action (self-responsible, creative etc.) are the precondition for the reduction of complexity. However, what makes an action competent is the successful attempt to find an agreement about the definition of a situation that leads to the characterised outcomes. This agreement is independent of the context and any observer.

3.6 Conclusions

If we agree on the description of competent action, the next step is to find out what competence is alike. As we saw above, most attempts try to derive it from the outcome of a competent action, the performance. 'For the reasons just outlined, this is an unfounded hope. Whereas we commonly make inferences about a person's capabilities, abilities and skills on the basis of performance, such attributions always involve assumptions about the nature of these capacities. The nature of the capabilities, abilities and skills involved in performances of various kinds are typically contested, as also is the best way to develop such capabilities, abilities and skills' (Hager 2004, p. 421). I agree with the view of Hager concerning the impossibility of making inferences to describe competence. However, it mixes up several terms. Capabilities, abilities and skills are concepts on their own. It does not make any sense to name some of them 'competence'. Instead I suggest to derive competence from the results of our action-theoretical preliminary work.

One central term of our investigation was the 'situation'. A situation is more than just being in circumstances. It is a field of potential actions that initially has to be defined by the actors: 'If men define situations as real, they are real in their consequences' ('Thomas theorem', Thomas and Thomas 1928, pp. 571). In the example above, the clerk and customer are together in the same sphere of time and space. The main difference is the perspective of what should happen in this sphere, i.e. the definition of the situation. The customer wants to return something; the clerk strives for doing the right thing for her job. What they share is a common field of action possibilities. The action possibilities are emergent in the sense that in a situation, potentially very many possibilities to act exist. The definition of the situation reduces this complexity so that if a situation is defined, the intentions emerge. If more than one person is bound to a situation, they are dependent on a common definition of the situation. That is what the clerk and the customer try in our example: to find a common definition of the situation that satisfies the needs of both.

How can a situation be *defined*? Following a phenomenological approach, a situation is a segment of 'referential contexts of our lifeworld', i.e. the lifeworld already refers to what can be the definition of a situation and the situation contains the reference to the corresponding segment of the lifeworld: 'As the what-for of the hammer,

plane, and needle, the work to be produced has in its tum the kind of being of a useful thing. The shoe to be produced is for wearing (footgear), the clock is made for telling time. The work which we primarily encounter when we deal with things and take care of them – what we are at work with – always already lets us encounter the what-for of its usability in the usability which essentially belongs to it. The work that has been ordered exists in its tum only on the basis of its use and the referential context of beings discovered in that use' (Heidegger and Stambaugh 1996, pp. 65).

To define a situation in this context means to *choose* the adequate segment of the lifeworld by bringing up a theme. This is always directed to and limited by the *horizon*. The horizon can be seen as the scope of possible situations that is formed by the experiences represented in our lifeworld, i.e. we will only define those situations that are embodied in the lifeworld which itself changes with every new experience and – of course – with learning. 'Perspective and horizon are the interrelated features of what is phenomenologically called a situation (…). Being situated is the ongoing *movement from the actual to the possible*, the present to the future, the given to the new, the real to the imaginary. This movement or change is the principle of what we call experience and behaviour. To live means to live in and toward changing horizons' (Graumann 1989, p. 97).

A situation as a segment of one's lifeworld is generated by themes or topics. It can be generated by others or by the actor, i.e. we can be confronted with a situation – like the clerk in our example – or produce it, e.g. by inventing something, doing research, etc. Competent action appears on the one hand in a specific way of coping with a given situation; on the other hand, it can mean the generation of a situation itself: 'Competence implies control over environmental factors – both physical and social. People with this motive do not wish to wait passively for things to happen; they want to be able to manipulate their environment and make things happen' (Hersey and Blanchard 1972, p. 34). This manipulation is the result of the creation of situations. If someone generates a situation, then he/she brings up a theme which is – as part of his/her lifeworld – founded in pre-intentional aspects. Due to the thematisation of a part of the lifeworld, this part gains importance as horizon for actions. The reflection of the situation thereby forms the intentions of the actors. How can we now imagine the creation of situations? In principle, we can assume two configurations: (1) a situation is created by a new theme and (2) a new situation is created out of another by moving the horizon of the situation. Since situations are always part of the lifeworld and the lifeworld forms both the context and horizon, creating situations seems to be merely a shifting of the situation's horizon. We are most of the time in situations and move from one to the other, without departing from them. Therefore, the generation of new situations also usually starts from an existing one.

However, new situations can also address a different part of the lifeworld that has no direct connection with the current one. This means that a new situation is indeed born from an existing one, but this does not necessarily occur as a shift of the horizon of the existing situation, but is generated only against their background. Situations are always present as part of the lifeworld. In this sense, the 'generation' does not

mean the creation of a previously nonexistent situation, but the becoming aware of and the thematisation of potentially already existing situations. This 'becoming aware of', which results from biographical i.e. from pre-intentional aspects, is based on intentional states such as interests, opinions, etc. This also means that the creation of situations is not an intentional act. If the directing of attention comes out of pre-intentional aspects, then it cannot itself be a subject of intentions, just as the 'forming' of intentions is not an intentional act itself. I cannot intend that I become aware of something. In this sense, creating situations 'happens'.

What lets this creation of situations happen, i.e. that someone is getting aware of and thematises a situation, is what could be called 'competence'. To distinguish from this competence is the 'competent acting' that takes place in the management of an action situation. Competence in this respect would be the sum of pre-intentional aspects of acting that can reduce the complexity of the individual lifeworld and thus forms the basis for competent action. We saw in the example above that the clerk had different opportunities to act. We could say that it depends on her reflection of the situation (of the part of her lifeworld), which opportunity she chooses, and it depends on her definition of the situation (i.e. the theme she chooses, whether confronting the customer, asking her supervisor, negotiating with the customer, etc.), if the corresponding action could be seen as competent. Actually the situation is not existing on its own as an entity that would exist outside of the actors. It is rather a construct that is created by the acting people. It is thus not the *interpretation* of the situation that leads to the competent action but the (common) *construction* of the situation. This construction however can only happen against the background of the clerk's (and of course the customer's) lifeworld that contains her interpretative patterns, represented by the different intentional aspects mentioned above.

This competence is not causally determining competent action, just as intentions are not the causally determining actions (you might have an intention without performing the corresponding action), although there is a correlation between competence and competent acting in the form that competence is the reason why an actor is able to act competently. However, if it would be causally determinative, then it would mean that every action that we cannot identify as competent would suggest a lack of competence of the actor. This is not the case, as we saw in the beginning. Competence in this description means that their origin refers back to the (also professional) biography of the actor. What enables him/her to become aware of and thematise situations is in this respect based on his/her education and socialisation processes. This points to the development character of competence we find in almost all the different competence concepts. And, finally, it means that *everyone is competent*, only to different degrees. Everybody in principle can generate situations. If not, we wouldn't generally be able to act. Additionally, everybody is able to act competently, depending on how far developed his/her ability to becoming aware of and to thematise situations is.

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Chapter 4
Competence and Professional Expertise

Arnoud T. Evers and Beatrice I.J.M. van der Heijden

4.1 Introduction

The performance of our society as a whole is largely the result of the existence of multiple coherent working systems in which competent employees display their knowledge and skills in different kinds of jobs and in different working settings and are able to compete with important counterparts. Each professional person, as such, must possess a certain degree of expertise in his or her specific job domain. Confidence in professional people – teachers, secretaries, librarians, surgeons, psychiatrists, pharmacists and lawyers, for instance – is based to a great extent on the assumption that these people know what is best in terms of their own profession and that it is in outsiders' best interests to accept their opinion.

Where it is impossible for a person to function competently, for example, owing to a deficient physical or mental condition or a situation of diminished responsibility, there is an even greater need to rely on specialist third parties. Take, for example, the patient's dependency on medical specialists in the case of life-threatening injuries. Moreover, the pace of everyday life forces us to make so many choices and decisions that we have no alternative but to defer to experts, relying on their

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knowledge and experience to compensate for our own limited time and range of capabilities.

In business and in the service sector, expertise is assumed to be the norm and at the same time taken for granted, in blissful ignorance of the obstacles that have to be overcome to attain the level desired. The road one has to take to get there is frequently full of impediments. Of course, individuals differ considerably, and it is not necessary for every single person to be in the group of top performers in his or her specialist domain. Furthermore, there are great differences in the complexity of each domain of expertise.

In some domains this complexity can be partly compensated for by devices such as statistics and other tools, including computer programmes, technological aids, computerised memory systems, simulation techniques, etcetera. But still the fact remains that the possibilities these aids provide are restricted and one is always confronted with situations in which one is dependent on the 'human expert', that is to say, the person with the know-how to overcome the constraints and negative aspects that are inherent in the aids used and who is able to draw on the necessary skills and make a personal creative contribution in order to solve the problem in question. Nowadays, one of the most important problems in the domain of personnel management is to find out whether influential factors can be detected that stimulate or hinder the development of individual employees throughout their career. Throughout the last three decades, career researchers have focused on the idea of development throughout one's career, taking into account age-related problems (see Van der Heijden 1998 for a review on this topic). This attention shows the growing concern about the development of professional expertise throughout the working life. Literature also reveals that learning of professionals in practice is getting more important (Cheetham and Chivers 2001).

In this chapter, both 'competence' and 'professional expertise' are dealt with and used interchangeably, referring to the personal qualities and capabilities that are needed in the present-day workforce (Van der Heijden 1998). Competence involves not only ability but also the allocation and acceptance of responsibility in one's job. This responsibility is not logically inherent to one's expertise, but it is probably an indispensable condition for learning or gaining expertise. Therefore, it is essential for an organisation to have at its disposal people who are able to bear responsibility and whose interaction supplies the organisation with the expertise needed. Moreover, an increased expertise development is only possible in case management regards investments in a certain employee as profitable.

Furthermore, professional expertise can only achieve its potential in a situation where an employee is able to exploit or sell the knowledge and skills with which he or she is equipped and where the degree of intensity, amount of time available, degree of difficulty of the task and the amount of personal responsibility are sufficiently challenging. For example, gifted people not given the opportunity to employ their faculties tend not to be regarded as experts. This is why professional competence and professional expertise are interpreted as having the same meaning, namely, expertise at work. The next section will go into profound concept analyses regarding the terms competence and professional expertise.

4.2 Defining the Concept of Competence and Professional Expertise: Towards a Conceptualisation

Theoretical and empirical controversy abounds with regard to the understanding and potentials of the concept of expertise. The problem of definition is further complicated by the different qualifications in use for somebody who can exhibit expert behaviour. Some examples are a person of genius, or one who is talented, gifted, competent, prodigious, capable, excellent and proficient, to mention only a few. The divergent meanings attached to the concept of expertise create great confusion, mainly owing to the domain-specific character of expert behaviour (cf. Curtis 1986; Logan 1985; McLagan 1997).

Moreover, even within one specific domain, different definitions were sometimes used, depending on the prevalence of research approaches. As a generally accepted operationalisation of the concept was missing, Van der Heijden (1998) started her scholarly research with working at an operationalisation of the person-related concepts of 'competence', 'expertise' and 'being an expert'. Both what a person *knows* and what a person actually *does*, revealed by his or her overt behaviour, were taken to be the key issues in studying professional expertise. Following the line of thought that has been explained previously, competence and expertise are generally used interchangeably for the same (psychological) attribute. For the meaning of competence, please see the first chapter of this volume, in which its conceptualisation is thoroughly addressed. The meaning that is given to *expertise* (Sinclair 1992, p. 495) is 'special skill or knowledge that is acquired by training, study, or practice: a formal word. For example … his professional expertise … … the technical expertise of the two Spanish firms'. Similarly, an *expert* is specified as 'a person who is very skilled at doing something. For example, what an expert can do in minutes takes you hours … … experts in various skills … Experts were called in to dismantle the bomb'. And as 'a person who has studied a particular subject and knows a lot about it. For example, … an expert on Eastern philosophy … … the financial expert who writes in The Times … … experts in obscure subjects … Experts say the company will fail'. 'Someone who is *expert* at doing something is very skilled at it. For example, only expert acrobats can master these activities … They have to be expert at dealing with any problems that arise'. 'If you say that someone has *expert* hands or an *expert* eye, you mean that they are very skilful or experienced in using their hands or eyes for a particular purpose. For example, he rubbed his expert hands over the wound …, … not noticeably except to the expert eye … He ran an expert eye over the photographs'. '*Expert* advice, opinion, or help is advice, opinion, or help that is given by someone who has studied a subject thoroughly or is very skilled at a particular job. For example, we would like an expert opinion … Get expert treatment from a specialist … The appliance needs expert attention'.

Expertise (Merriam-Webster 1975, p. 403) is also described as 'expert opinion or commentary' or 'skill in a particular field', for example, technical know-how. Correspondingly, *expert* is the indication of someone who is 'experienced' and 'having, involving, or displaying special skill or knowledge derived from training or

experience'. A second specification is summarised as 'one who has acquired special skill in or knowledge of a particular subject (authority)'. Finally, the word is used in sentences such as '… to serve as an expert for …' and 'to serve as an expert'.

In the next paragraphs, there is a discussion of the definitions and comments from the relevant literature on these matters. Both information on competence on the one hand and on expertise and experts on the other have been included (see Appendix 1 in Van der Heijden 1998 for a full overview of definitions and descriptions of characteristics grouped, firstly, according to three definition levels, and, secondly, five sets of views or notions concerning professional competence or expertise).

In her aim to come up with a measurement instrument for professional expertise, Van der Heijden (1998) focused on individual competence or attributes of individuals, consisting of professional knowledge and skills. During the analysis, a possible subdivision of individual competence definitions and descriptions into five sets of views or notions emerged.

According to the first view, professional expertise is seen as an attribute of individuals who possess a vast amount of relevant knowledge. The second view is founded on the idea that professional experts are aware of their own performance and are able to rationalise it. They have, so to speak, metacognitive knowledge. The notion of a high amount of skills comprises the third view. Professional experts possess capacities, apparent from their overt behaviour, to perform qualitatively well in their domain of expertise. They sometimes even surpass the norms set by their superior. According to the fourth view, the expectations and recognition of a professional are central, signifying the credit that is attached to his or her achievements. A fifth view of the concept focuses on the difference between domain specificity and capabilities that exceed specific fields of expertise. In other words, it relates to the aspects of growth and flexibility. Following this perspective, the changeability of one's expertise is emphasised, negating a static view of expertise.

Five dimensions of individual expertise can be distinguished on the basis of the five views or notions that have been explained above: (1) knowledge, (2) metacognitive knowledge, (3) skills, (4) social recognition and (5) growth and flexibility.

In the light of Van der Heijden's (1998) aspiration to isolate the ingredients for the operationalisation in terms of measurement scales in the instrument, categorising the different definitions and descriptions on the individual level has proven to be extremely useful. Before her endeavour, only speculative remarks regarding the possibility of finding common ingredients of expertise have been made (Spencer and Spencer 1993) (see Van der Heijden 1998 Appendix 2 'Different views on expertise and experts' and Appendix 3 'Generalizations regarding the phenomenon of expertise' for more elaborate literature overviews).

The fifth dimension on the changeability of professional expertise instigated our work on the *development* of professional expertise and professional development, as will be discussed in the next section.

As such, from reviewing relevant literature, it was concluded that expertise is a multidimensional concept. It follows that a multidimensional operationalisation of professional expertise must comprise the different types of knowledge inherent in a

certain professional field. These different types of knowledge are *declarative* knowledge ('knowing that'), *procedural* knowledge ('knowing how') and *conditional* knowledge ('knowing when and where or under what conditions') (Alexander et al. 1991).

This first dimension by which professional expertise was operationalised was therefore termed the *knowledge dimension*, which is closely related to the second dimension called the *metacognitive knowledge dimension* (i.e. knowing about knowing or knowing that one knows). This dimension, which has to do with self-insight or self-consciousness, is known in the literature by a number of different labels: metacognitive knowledge, meta-knowledge, executive control knowledge, self-knowledge, regulative knowledge and metacognitive strategic knowledge, to mention but a few.

The third dimension referred to the particular skills an employee needs to perform requirements for professional tasks. Once the activities and responsibilities have been defined, it became clear which skills were necessary to perform a given job. A person can only be referred to as an expert if his or her overt behaviour demonstrates the capacity to perform qualitatively well in a particular domain. This third component of professional expertise was termed a *dimension of skill requirement*.

The three dimensions outlined so far are fairly commonplace to earlier conceptualisations of the construct of expertise (e.g. Bereiter and Scardamalia 1993; Chi et al. 1988; Ericsson 1996; Ericsson and Smith 1991). However, the opinion that expertise is fully explained by these three dimensions is not shared by all researchers (Boerlijst et al. 1996). Measurement of cognitive abilities and skills is not enough to fully cover the construct of professional expertise (Ericsson and Lehman 1996; Trost 1993). Motivational aspects and self-insight, as well as social skills, social recognition and growth capacities are important variables that interact and moderate. That is to say, there is a compelling reason for proposing a broader type of measurement in which cognitive abilities and overt skills play an explicit, but partial role (Van der Heijden 1997). Thus, there is a need for alternative perspectives in order to measure expertise effectively.

Expertise can only exist by virtue of being respected by knowledgeable people in the organisation. There are a number of individuals who have a vast amount of knowledge and/or skills. However, not all of them can be considered as highly skilled or as experts, owing to a lack of social intelligence, communicative skills and so on. This fourth important aspect of professional expertise can be labelled the *dimension of acquiring social recognition*. For the development of professional expertise, it is essential to be recognised as a promising employee. From an earlier study, it was concluded that the possibility to experience further development correlates closely with the reputation a person has within the organisation (Boerlijst et al. 1993).

A fifth dimension that was added to the conceptual framework was the *dimension of growth and flexibility*. Individuals who are capable of acquiring more than one area of expertise within adjacent or radically different fields or who are capable of acquiring a strategy to master a new area of expertise or expert performance in another territory can appropriately be termed 'flexperts' (Van der Heijden 1996).

These are people who are both flexible and in the possession of expertise at the same time. However, without a certain amount of perseverance, there is no continuity in the classification of an employee as expert. Achievement orientation is 'a concern for working well or for competing against a standard of excellence' (Spencer and Spencer 1993, p. 25).

Therefore, each of the five measurement scales that are aimed to cover the five distinguished dimensions of professional expertise, with the exception of the social recognition scale, contains one to three items concerning the dynamic component of *achievement orientation* as possessed by the employee. In the dimension of knowledge, one item refers to achievement orientation. The metacognitive knowledge dimension contains two items, and the skill dimension and the dimension of growth and flexibility contain three items regarding 'the level of perseverance' (Van der Heijden 2000, p. 11–12).

Thorough psychometric validation studies indicated that the domain-independent multi-trait (employee version and supervisor version) measurement instrument for professional expertise is valid and reliable (Van der Heijden 2000). The instrument has proven to be useful as a means of identifying professional expertise and expert performance and finding individuals who need support to improve and excel further. The scales have also been used as a research instrument in studies of professional development (Evers et al. 2011a, b; Heerkens et al. 2011; Njoku et al. 2010).

4.3 Stages of Competence or Professional Expertise

In addition to literature that focuses on *defining* competence or professional expertise, as discussed until now, an important stream of research focuses on different stages or levels of expertise (e.g. Boydell 1990; Cornford and Athanasou 1995; Dreyfus and Dreyfus 1986; Kose and Lim 2011). Dreyfus and Dreyfus (1986) discerned five stages of becoming an expert (see also in Cheetham and Chivers 2001 and Eraut 1994):

1. Novice. In this stage there is a rigid adherence to taught rules or plans and there is little situational perception and no discretionary judgement.
2. Advanced beginner. Guidelines for action are based on attributes or aspects; situational perception is limited; all attributes and aspects are treated unconnected and given identical importance.
3. Competent. The person can cope with overcrowding, can see actions at least partly as longer-term goals, is able to plan consciously and deliberately and can apply standardised and routinised procedures.
4. Proficient. The person sees situations holistically and not in terms of aspects, sees what is most essential in a situation, sees deviations from the normal pattern, makes decisions with less labour and uses maxims for direction whose connotations differ according to the situation.
5. Expert. The person no longer depends on rules, guidelines or maxims; has an intuitive grip of situations established on deep, tacit understanding; has analytical methods used only in new situations; and has a vision of what is possible.

Dreyfus and Dreyfus (1986) see learning from experience as the main ingredient of transition through the various stages. Correspondingly, Kose and Lim (2011) used a similar although simpler model to measure teachers' self-reported expertise: they distinguished between the following four categories: novice, intermediate, advanced and expert.

The Dreyfus and Dreyfus (1986) model has been criticised for being too stratified and hierarchical (Cheetham and Chivers 2001). After all, an individual may display certain characteristics from several stages or levels at the same time. It is also possible that different individuals have a usual inclination towards either intuitive or analytical styles of problem-solving and decision-making. Apart from this criticism, which in our view applies to most models, the stages show that it takes a considerable amount of time to become an expert in the field. Cornford and Athanasou (1995, p. 12) stated: 'The attainment of a level of expertise in highly skilled professions will generally not be attained before a minimum of 5 years in that speciality and there is ample evidence that 10 years may be typically the norm'. Although Cheetham and Chivers (2001) mentioned that the authors do not elaborate upon what they exactly mean by 'ample evidence', other authors also mention this ten-year rule: at least 10 years of study and practice in a field are required to achieve expertise (Ericsson et al. 1993; Simon and Chase 1973). However, it is not only the invested time in practice that matters in reaching an expert level of performance. Ericsson et al. (2007) concluded that research shows that the making of an expert is the product of years of *deliberate practice and coaching*, not of any innate talent or skill. Deliberate practice is a particular kind of practice to develop expertise. It is not about focusing on the things people already know how to do. Instead, it is about considerable, specific and sustained efforts to do something you *can't* do well yet – or even at all. Deliberate practice is defined as 'expanding intentional efforts to achieve further improvement through focused, concentrated, well-structured, programmatic, and goal-oriented practice' (Chi 2011, p. 28; Ericsson and Lehmann 1996). Research across domains indicates that only by working at what you can't do well yet will turn you in the expert you want to become (Ericsson et al. 2007). In addition to deliberate practice, the type and quality of the development activities engaged in matter as well in case one aims to reach an expert level of performance (Van de Wiel and Van den Bossche 2013). These aspects of development activities will be dealt with after the next section about the necessity for expertise development. As professional expertise and competence are interpreted to have the same meaning, only reference to professional expertise is made in the remainder of this chapter.

4.4 The Need for Professional Expertise Development

Being an expert and maintaining one's expertise are by no means an easy task. However, the potential of a given organisation to perform optimally in global markets depends on the capability to develop, cultivate and maintain fundamental

qualifications. Added to this is the fact that these qualifications are continuously changing at an ever-increasing rate. There are three fundamental tendencies underlying these changes.

Firstly, there is the emergence of the information society which in fact entails ongoing industrial revolution producing substantial changes in job content. This means that the speed of thinking that is required from an individual employee is constantly increasing. The second change is the internationalisation of the economy which means an ever-growing acceleration of knowledge exchange on a global scale. Thirdly, scientific and technological progress implies a continuous need to update one's expertise. Consider, for example, the large-scale influx of computers, the information explosion and the exponential increase in technical knowledge. A characteristic of the above-mentioned changes is that not only do they produce new expertise needs but, at the same time, they create new opportunities for learning. The qualifications that are required for a job are becoming increasingly complex, but, simultaneously, the 'half-life' of these qualifications is becoming increasingly shorter. Job requirements need constant replacement and adjustment because of the danger of becoming outdated.

Individuals who are able to survive and satisfy the needs of the new organisation are the ones with not only the most up-to-date knowledge and skills but also the capability to continuously build up the new expertise requirements. Thus, achieving flexibility in functioning, or adaptive expertise, over and above so-called routine expertise (see Hatano and Inagaki 1986 for thorough conceptualisations of both concepts) seems to be the key criterion that enables an employee to stay in the race. Routine experts are 'able to complete school exercises quickly and accurately without understanding', whereas adaptive experts have 'the ability to apply meaningfully learned procedures flexibly and creatively' (Hatano 2003, p. xi). Bohle-Carbonell et al. (2014) call for more research into the differences between adaptive and routine expertise, its dimensionality and the development of adaptive expertise. That is to say, additional insights into how to design learning environments and tasks that support its further growth are needed. Adaptive expertise allows employees to perform at a high level in the face of changing job requirements and work methods, herewith differentiating it from routine expertise. Having an expert level of functioning entails using schemas, selective attention, chunking information, automaticity and more reliance on top-down information. These mechanisms allow experts to perform quickly and efficiently; however, at the same time, they restrict flexibility and control, which may cause the experts to miss and ignore important information and introduce tunnel vision and bias, to mention but a few effects that may degrade their performance (Dror 2011, p. 177). These effects can be noticed across a wide range of professional domains, herewith stressing the need for more insights into possible ways of continuously developing one's professional expertise across professional settings, in order to actively prevent leaning on routines only and to stimulate the growth of adaptive expertise. Given the above-mentioned increased need for flexibility in the workplace, adaptive expertise is more and more key in the light of one's future employability (Van der Heijde and Van der Heijden 2006). To summarise:

there is an ever-increasing need for expertise development. But how can expertise exactly be developed? What forms of learning can be discerned?

4.5 Professional Expertise Development

Professional expertise, as has been discussed in the previous section, can be seen as *what* is being learned. In this section an exploration will follow of *how* one learns and, more specifically, how one learns from different forms of learning: formal, non-formal and informal. Characteristics of these types of learning will be discussed, but the actual design principles will not be elaborated on (e.g. with regard to formal learning, the actual curriculum design). This is left to other authors in chapters in this volume to explore. Traditionally, interest (in practice as well as in research) has focused on formal (professional) learning or education, while interest in non-formal and informal (workplace) learning has only increased since the beginning of the 1990s (Tynjälä 2008). This latter increase can be partly explained by the rapid change in society and working life, the rapid development of information and communications technology and the increasing internationalisation and globalisation which have challenged educational institutions and work organisations to ensure that the workforce is able to meet these challenges (Tynjälä 2008). Another reason for an increase in this interest in non-formal and informal learning is related to the problems encountered in transferring what has been newly learned during formal learning activities to the workplace (Baldwin and Ford 1988).

Formal learning consists of participation in formal training and development programmes in educational institutions and in-service training programmes. In-service training can be seen as formal learning opportunities across the career cycle (Richter et al. 2011). But a rising trend can also be seen in following formal programmes in educational institutions (e.g. master programmes and other structured learning environments with a specified curriculum) as formal learning opportunities across the career. An often heard strength of formal education is that it is aimed to produce general skills that *may* be applied and transferred to a variety of situations (Tynjälä 2008). A problem however is *how* the newly learned could be transferred to the workplace.

Apart from formal learning, non-formal and informal learning can be distinguished. Non-formal learning refers to intentionally organised learning activities related to work, for example, mentoring (Tynjälä 2008) or intentional practicing of certain skills in learning projects (Poell 2006). With regard to mentoring, interaction between novices and experts is crucial for learning at work. In the process of mentoring, one can distinguish between direct or close guidance and indirect guidance (Billett 2004). This kind of guidance is relevant to obtain knowledge that would be hard to learn without the support or assistance of a more knowledgeable and experienced partner. Poell (2006) developed a model of learning projects that have the specific intention to learn and to improve work at the same time. In these projects employees learn something new by resolving work-related problems. Poell (2006)

has shown in his empirical studies that in these kinds of projects, participants are indeed able to develop their competencies and at the same time improve their work.

Informal (incidental) learning is not highly structured and often takes place as a side effect of work (Tynjälä 2008). This type of learning comprises implicit processes that lead to the acquisition of knowledge without any explicit awareness or conscious effort of what has been learned. These implicit processes result into the kind of tacit knowledge on which people, for example, make decisions apparently intuitively (Reber 1993). Informal learning suggests flexibility or freedom for learners, distinguishes the social significance of learning from other people and takes place in a much wider variety of settings than formal education or training (Eraut 2004). Investigating informal learning is not without problems, as informal learning is either taken for granted or not recognised as actual learning (Eraut 2004).

Although informal learning is difficult to investigate and the categorisation between non-formal and informal learning is not without problems, these types of learning are assumed to be highly important learning activities which can be complementary to formal learning and need to be acknowledged. Indeed, nowadays, there is more attention in organisations for learning that is embedded in work activities, and that is linked to innovation of products, services and work processes (Van der Klink 2011). However, a difficult question for organisations seems to be which organisational conditions are important for these non-formal and informal learning activities to have the desired effect, namely, an increase in professional expertise development. In the next section, this will come back.

Before going to the next section, about organisational conditions, now a concrete example of a professional field will follow, i.e. the teaching profession, which can serve as an illustrative profession, where professional expertise development is more important than ever. Nowadays, teachers, specifically those in primary and secondary schools, need to be prepared for changing demands stemming from expanding knowledge fields (e.g. ICT developments), more varied student and pupil populations, new responsibilities and higher social expectations of schools (OECD 2005). In order to be well prepared for these demands and challenges, teachers' expertise development is crucial and has become a vital concern for schools in many countries worldwide (Commissie Leraren 2007; National Staff Development Council 2009; OECD 2009). Teachers' expertise development is closely related to another concept which can be found in the literature: teacher professional development (TPD). One could say that TPD has a somewhat broader scope than teachers' expertise development, although the definition of TPD is very similar: 'The process by which teachers acquire the knowledge, skills and values which will improve the service they provide to clients' (Hoyle and John 1995, p. 17). This process comprises teachers' participation in the aforementioned formal, non-formal and informal professional learning activities.

Worldwide, many policy initiatives have been taken to stimulate TPD. For example, in the United States of America, many states have accepted standards to stress expectations that all teachers have to engage in effective professional development (Darling-Hammond et al. 2009). In a similar vein, across Europe, countries are seeking ways to offer opportunities and incentives for ongoing professional devel-

opment throughout the career (OECD 2005). There is even improvement in the supply and diversity of professional development including formal, non-formal and informal learning activities (Commission 2010). Especially for non-formal and informal learning activities, it is crucial to focus on beneficial organisational conditions.

4.6 Organisational Conditions for Professional (Expertise) Development

Besides organisational conditions, there are other types of conditions, which are relevant for professional (expertise) development, for example, at the macro level (the *likelihood of losing one's job*, *support from outside the workplace*), characteristics of the *learning activity* itself and socio-demographic characteristics (like *initial level of education*) (Kyndt and Baert 2013). Personal characteristics are also essential in this regard (Billett 2004; Kyndt and Baert 2013; Tynjälä 2008). While organisational conditions set the context and conditions for learning, it is a reciprocal interaction between the individual and the workplace or organisation that determines learning (Billett 2004; Tynjälä 2008). For example, a positive *attitude* towards learning and *self-efficacy* (Kyndt and Baert 2013), the latter defined as the confidence in one's capability to activate resources to meet situational demands (Bandura 1977), are crucial determinants for professional development to take place. That being said, it seems that particularly organisational conditions can be influenced by, for example, HRD professionals and directors, and therefore it is interesting to elaborate on particularly these conditions.

Previous work investigated organisational conditions for *professional development* (Eraut 2004; Evers et al. 2011a; Kwakman 2003; Kyndt and Baert 2013; Opfer and Pedder 2011; Sambrook 2005), although some studies also focused on the predictive validity of organisational conditions for *professional expertise development* (Van der Heijden 2001; Van der Heijden 2002; Van der Heijden 2003; Van der Heijden 2006). In both cases these studies focus on the conditions for development or learning.

Kyndt and Baert (2013) performed a systematic review study on the antecedents of employees' involvement in formal and informal learning activities, both on and off the job, whereby employees and groups of employees acquire and/or improve competencies (integrated knowledge, skills and attitudes) that may change their present and future professional achievement and organisational performance. At the organisational level, they distinguished two categories. The first category of antecedents that was dealt within their analyses refers to the characteristics of the organisation. The *firm size*, for example, appeared to be positively related to participation in especially formal learning activities, but also to informal learning activities. Several empirical approaches that were included in their review examined differences between organisations in different *sectors*, *industries* and *departments*.

Although some studies did not find differences between sectors, others did find that employees in the public and non-profit sector participated more in formal learning activities in comparison to those in the private and profit sector.

The second category of antecedents dealt with organisational variables or factors (Kyndt and Baert 2013). The first factor, which has been investigated by a lot of researchers, is (organisational) *support*. A majority of studies as discussed in Kyndt and Baert (2013) found organisational support to be positively related to participation in development activities. The *learning climate or culture* was also found to relate positively to participation in learning activities. A positive learning climate or culture is defined as an organisational climate that values, supports and appreciates work-related learning. Moreover, within informal learning, a culture of feedback plays an important role. A *company policy* that facilitates participation in learning and development activities and a *staffing strategy* that focuses on the internal (from within the organisation) development of expertise were also found to be positive predictors for development to take place. Another important organisational factor appeared to be the different *opportunities* for learning an organisation offers to their employees. For example, the availability of development resources [learning materials and time, see also Sambrook (2005)] related positively to on-the-job learning. Similarly, learning opportunities at work correlated positively with informal learning success. Another example of opportunities for learning are the possibilities for collegial feedback, which was an important variable for participation in various kinds of informal learning activities. Similarly, Fuller and Unwin (2003) addressed the significance of an appropriate context to maximise learning opportunities, which they call expansive learning environments (opposed to restrictive environments). In such an environment, employees are enabled to participate in communities of practice, have opportunities for personal development and are offered enough institutional arrangements.

Apart from opportunities for learning, Eraut (2004) found *expectations of performance and progress* to be an important condition for informal learning in the workplace. He stated that the informal role of managers is probably more important in this context than their formal role. Finally, Kyndt and Baert (2013) presented the influence of *organisational change*, although no clear conclusion could be drawn about whether organisational change as such influences the participation in development activities.

A very specific organisational factor, which can also be perceived as a separate category (Evers et al. 2011a; Kwakman 2003; Kyndt and Baert 2013), refers to task or job characteristics. For example, *participation in decision-making* was related to participation in learning activities (Kwakman 2003; Kyndt and Baert 2013). Another example is the role of *job demands* and *job control* in participation in development activities. Some studies that were taken up in the review work by Kyndt and Baert (2013) showed that job demands are positively related to work-related development. One study showed that job control was moderately positively related to work-related learning. The results of another study showed that most learning occurs when both job demands and job control are high. Finally, the so-called learning value of the function (the latter defined as ‘the value which the function has as a

nutrient for the employee's further professional development') (Boerlijst et al. 1993, p. 57) is another important example of a task or job characteristic that has proven to have predictive value in the light of one's further development (Van der Heijden and Bakker 2011). As an illustration, now the chapter will go back to a specific example of a professional field, the teaching profession.

In addition to the above-mentioned factors, Evers et al. (2011a) discussed two factors based on their literature study which were explicitly important in the teaching profession. First of all, the extent of *trust* in a school was considered to be relevant. Trust was described as one party's willingness to be vulnerable in the relationship with another party (colleagues, the school head and parents), based on the assurance that the latter party is benevolent, reliable, competent, honest and open (see also Tschannen-Moran 2001).

The second factor they added and which receives more and more attention nowadays as being a crucial factor for enhancing professional (expertise) development in school environments is *transformational leadership*. In the last two decades, a shift has taken place from 'transactional' leadership, wherein the exchange relationship between leaders and teachers is important (effort and productivity in exchange for rewards), to 'transformational leadership', which is characterised by leaders having the ability to give a clear vision for the future, to inspire employees, to stimulate employees to develop their talents in the best possible way and to give their work a deeper meaning (De Hoogh et al. 2004). Also from empirical work, transformational leadership appeared to be an important predictor for professional development of teachers (Geijsel et al. 2009; Runhaar, 2008).

4.7 Conclusions

The pace of everyday life forces people to make choices and decisions where there is no alternative but to defer to experts, relying on their expertise to compensate for our limited time and range of capabilities. Each professional person must possess a certain degree of expertise in his or her specific job domain. This is necessary to enable their own further career growth, but also to stimulate outsiders of their own profession, so-called laypersons, to accept their opinion and to have faith in their professional approach.

More and more, vocational preparation can only partly provide one with the necessary knowledge and skills' bases, and life-long learning is necessary to 'stay in the race'. Indeed, professionals' learning is getting more important. However, nowadays, one of the most significant difficulties in the domain of personnel management is to find influential factors that stimulate or hinder the development of employees throughout their career. First, periodic monitoring of one's competence base is the only way to survive and meet current labour market requirements and to provide the necessary input to fine-tune learning activities. In order to do so, organisations should make use of performance appraisals, such as the one that has been advocated in this study, that have proven psychometric qualities (i.e. reliability and

validity). After a careful registration of the amount of competence or professional expertise, management needs to invest in the maintenance and further development of employees. At the same time, organisations need employees who bear responsibility and whose interaction supplies the organisation with the expertise needed.

In this chapter, the text started with conceptualising competence and professional expertise and advocated these concepts to have the same meaning, namely, expertise at work. In conceptualising competence and professional expertise, the focus was on individual-level definitions, that is, on individual competence or attributes of individuals. Following this approach, a possible subdivision into five sets of views or notions emerged. First of all, professional expertise is seen as a characteristic of individuals who possess a large amount of relevant knowledge. Second, metacognitive knowledge is important. This is based on the idea that professional experts need to be aware of their own performance and need to be able to rationalise it. The idea of a high amount of skills comprises the third view. Fourth, recognition of a professional is crucial, signifying the recognition for his or her achievements. Fifth, it is not only important to be an expert in one's own domain but also to exceed specific fields of expertise. This relates to the aspects of growth and flexibility. On the bases of these five notions, five dimensions of individual expertise can be distinguished: (1) knowledge, (2) metacognitive knowledge, (3) skill requirement, (4) social recognition and (5) growth and flexibility (Van der Heijden 2000). The last notion instigated our work on the *development* of professional expertise. Thorough psychometric validation studies proved that the domain-independent multi-trait (employee version and supervisor version) measurement instrument for professional expertise had good psychometric qualities and provides a promising tool for further empirical work (Van der Heijden 2000). In addition to defining competence and professional expertise, also the stages of competence or professional expertise were discussed in this chapter, before elaborating on the need for *development* of professional expertise.

Currently, there is an urgent need for continuous development as qualifications and professional expertise requirements are continuously changing at an ever-increasing rate. There are three fundamental tendencies which cause these changes: (1) the rise of the information society, (2) the internalisation of the economy (globalisation) and (3) scientific and technological progress. Individuals who can survive and satisfy the needs of the new organisation are the ones with the most up-to-date knowledge and skills, but who also have the capability to continuously build up new expertise requirements. This means keeping abreast of new developments, continually fine-tuning one's expertise and fighting against rapid obsolescence. Employees can do this by working on their professional expertise development.

In this chapter, *development* was categorised into three forms or ways of learning: formal, non-formal, and informal professional learning. Subsequently, characteristics of these types of learning have been discussed, but not the actual design principles (e.g. curriculum design), which will be left for other authors in chapters in this volume to explore. Non-formal and informal learning activities may be complementary to formal learning and need to be recognised. Indeed, Evers (2012) recently found indications that these kinds of activities for teachers potentially even

reinforce each other. A difficult question for organisations remains: which organisational conditions are important for non-formal and informal learning activities to take place?

Following the outline of the different types of learning, the focus was upon a specific professional field, i.e. the teaching profession, where continuous professional development is more important than ever, as teachers need to be prepared for changing demands stemming from expanding knowledge fields, more varied student and pupil populations, new responsibilities and higher social expectations of schools. It was argued that *professional* development has a somewhat broader scope than *professional expertise* development, although the concepts are very similar, also in their definitions. Unfortunately, a lot of teachers are dissatisfied with the quality and outcomes of professional development and critically reflect on possibilities for improvement (Czerniawski 2013). Concrete experiences teachers most value are with, and from, their peers in informal groups, and not school-based training activities, which they often found 'pointless', 'wasteful' and 'forgettable'.

The final part of this chapter focused on organisational conditions for professional (expertise) development. Although other conditions, for example, at the macro level, learning activity level and personal characteristic level are also deemed to be important, the focus was on organisational conditions as these can be most easily influenced and changed by, for example, directors, HRD professionals and other stakeholders. First, at the organisational level, two categories were distinguished: characteristics of the organisation and organisational variables or factors. Important characteristics of the organisation were *firm size* (which is positively related to professional development) and differences between *sectors*. With regard to organisational factors, the following appeared to be important: (organisational) *support*, *learning climate or culture*, *company policy* that facilitates learning and development, *opportunities* for learning an organisation offers to their employees and *expectations of performance and progress*. Finally, task or job characteristics are relevant for professional development, like *participation in decision-making*, *job demands*, *job control* and *learning value of the function*. In addition to the mentioned organisational factors, two factors seemed especially important for the teaching profession: *trust* in school and *transformational leadership*.

In the context of discovering lacks in one's professional abilities, the distinction in five dimensions of professional expertise has proven to be fruitful. Once employees and management have more insight into the employees' scores for the five dimensions, it is known to guide the individual career development, where necessary, in order to improve the capabilities of the employee in question and to fill up consisting expertise gaps.

To conclude, although factors that are generalisable across a wide range of working contexts were looked into, their relative significance and how these factors interact will vary from one context to another and are sometimes counterbalanced by an opposing one. For example, control (or autonomy) and administrative direction, shared assumptions and diversity of opinion are all necessary (Opfer and Pedder 2011). Therefore users and researchers should collect evidence and information from their own context, before drawing any firm conclusions about which factors

are important and how these interact in their context. This kind of evidence can exist out of quantitative (e.g. surveys) or qualitative (e.g. interviews) data and other relevant documents via desk research. Moreover, the more diverse working population; the increasing importance of other areas in life, such as 'quality time' with family and friends, leisure, difference in coping style and personality; and the increasing individualisation, to mention but a few, urge management to prevent thinking in categories regarding, for instance, retirement age, professional development peaks, career success and learning needs. Employees have totally different ideas on and answers to professional development-related questions and need to be supported in fulfilling their individual aspirations, further developing their capabilities and meeting their expectations with regard to work and personal development.

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Chapter 5
Competence, Capability and Graduate Attributes

Len Cairns and Margaret Malloch

5.1 Introduction

This chapter offers a different perspective on the skills, attitudes and potential of learners as they engage with vocational and/or professional education. Whilst there has been an international movement during the last century towards a universal approach to basing vocational education on the idea of work-related *competence* (*or competencies and competency-based variations of the term*), the application and usage across the world have had a number of variations in definition and emphasis (Pottinger and Klemp 1975; Spencer and Spencer 1993; Mulder et al. 2006; Mulder 2007; Weigel et al. 2007; Sandberg and Pinnington 2009).

In the English-speaking world of the USA, UK, Canada, Australia and New Zealand, the model of what became known of as the competency-based education and training approach (CBET) rested heavily on a conceptualization and implementation of the theory within a somewhat tight *behaviourist* approach (Parnell 1978; Cairns 1992; Collins 1993; Harris et al. 1995). Mulder and his colleagues in their 2009 study refer to this as 'old practice' of competence-based education (Mulder et al. 2009).

As raised in previous chapters, the theory and definition of just what is meant by *competence* has been the subject of many papers, books and discussions, and this volume seeks to clarify and explicate the ideas and applications of the concept.

It could be argued that in much of the usage and underpinning justification for the adoption across education and training of the concepts and associated approaches

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under the *competence* banner, the essence was closely related to outcome-based ideas and views (Cooper 1981). The production of competent people, be they trade workers, semi-professionals or professionals, was the aim. This emphasis centred on competent individuals. Also amongst the justifications for the adoption of competency-based education and training was the perceived need for nations to be more internationally competitive and to enhance the skills base of the economy. This rationale figured prominently in the UK (Tuxworth 1989; Mansfield 1989) and Australian (Carmichael 1992; Peacock 1991) justifications for the adoption of the competency-based system.

For example, the initial government report on this strategy in Australia which is generally acknowledged as giving rise to the competency-based approach to vocational education and training in that country stated that:

> This report outlines a staged strategy for meeting Australia's training needs in 2001. It is not a short-term response to current levels of unemployment, but an essential part of a broad structural reform.
>
> This report addresses vocational education and training for Australian Standards Framework (ASF) levels 1, 2 and 3.
>
> Change is needed to improve our international competitiveness, to complement changes in work organization and industrial relations and to improve the coverage, quality and equity of vocational certificate training in Australia. (Carmichael Report 1992 p. vii)

The pervasive adoption (especially in vocational education and training) of the behaviourist influenced definition and application of competence in the UK, New Zealand, Australia and the USA led to a variety of critiques and reactions ranging from the positive, with acknowledgment of the changes and issues (Burke 1989; Mulcahy and James 1999), to critiques and discussions of philosophical differences (Sandberg 2000; Stevenson 1995; Méhaut and Winch 2012) and even disputes about a range of aspects (Norris 1991; Cairns 1992; Collins 1993). Even the strongest critics did realise and state that if the approach (CBT) was being questioned, it was incumbent upon the critic to offer some alternative:

> In any essay where there are questions raised about the efficacy of a strongly held or advocated approach there is an implicit 'demand characteristic' on the critic to offer some alternatives or at least some clarificatory complementary views. (Cairns 1992, p. 25)

In this 1992 presentation, which introduced the papers from an Australian National Teacher Education conference symposium on CBET, Cairns suggested that the emerging UK *Education for Capability* ideas might fit the bill for an alternative or complementary set of ideas and models to the competency-based education and training approach. Over the years since the early 1990s, in the UK and Australia in particular, what became known as the capability approach emerged and grew in influence and application as a more holistic idea which encompassed the competence ideas and moved the theory, research and application 'beyond competence'. This shift to a more holistic conceptualization of *competence*, in Australia, also was evident through a set of additional government committee reports (Mayer Report 1 (1992a) and Mayer Report 2 (1992b) that moved the competence definition and ideas into descriptions of what were termed *key competencies* which broadened the concept to some extent from the rigidity of the early behaviouristic

underpinnings. This trend has also been part of the more recent definitions and developments within the European approach where *key competencies* have developed in relation to the European Qualifications Framework (EQF) (OECD 2005; Cedefop 2009) and more holistic models of competence have been proposed (Rauner et al. 2013). This aspect will be taken up in more detail in the following sections.

In Europe, the development of a competence approach in the last twenty years, as outlined elsewhere in this volume, took a different approach in nations such as France, Germany and the Netherlands with less behaviouristic theoretical roots than was evident much earlier in the USA, Australia, New Zealand and the UK. There was clear awareness of these variations and somewhat of a 'softening' emerged (or more generously, a pragmatic broadening of the meaning of competence, in the most recent European interpretation).

In the Introduction to a special issue of the *Journal of European Industrial Training* on competence across Europe, in 2009, Winterton concluded, as a result of an extensive review of the various European definitions and operational practices surrounding competence-based models, that:

> The review having demonstrated the growing influence of multi-dimensional frameworks of competence, we were confident in proposing a unified, holistic typology based on a broader view of competence. The holistic competence model, combining knowledge, skills and attitudes, is gaining ground over narrower approaches and several authorities are developing more integrated approaches along these lines. Where interpretive approaches have also been influential, competence is inevitably viewed as being multi-faceted, holistic and integrated. Such an approach offers a unifying framework for defining the competences necessary for particular occupations and thus provides a starting point for establishing a typology of competences for the ECVET. (p. 690)

As mentioned briefly above, the Australian critics of the competency-based approach adopted there began to offer in the late 1990s and beyond a complementary, rather than direct, alternative to competence, in the form of the capability concept that had been developing in the UK via the Royal Society for the encouragement of the Arts, Manufactures and Commerce (the RSA), *Education for Capability* project.

5.2 Capability

In the UK, in the late 1970s, the RSA, as it has over many initiatives since the eighteenth century, launched a 'project' under the broad banner of *Education for Capability* (see Cairns and Stephenson 2009 for a detailed account of this development and the rationale). The essence of this approach (which had three sections, School Education, Further Education (TVET) and Higher Education) was that the RSA *Capability Manifesto* should be the guiding light for a shift in the paradigm of education where the two terms, *education* and *training*, were used differently and implied a meeting of what the RSA saw as a need for change in the UK.

The term *capability* is a unique word in the English language with, originally, few, if any, direct translations across other languages (Cairns 1997), though in the last few years, some have emerged as the term has circulated worldwide. It has a special association with the famous English gardener, Lancelot Brown, who became known as Capability Brown, because, it is suggested, he frequently described potential grounds of stately English homes he was asked to assess for improvements and design as 'having capability'. Interestingly, Brown's designs became the hallmark for natural-looking hills and clumps of trees arranged in a definite and open style as opposed to the more familiar Continental style of formal and geometric arrangements. We would argue that this approach symbolises the more natural and holistic nature of capability as we use it in this chapter.

The word capability also was used by the English poet, John Keats, to describe a style of poetry. In doing so he coined the phrase *negative capability*, which he defined, in a letter to his brother, as 'when a man is capable of being in uncertainties, mysteries, doubts, without any irritable reaching after fact and reason' (Keats 1817). Whilst the addition of the term 'negative' in this conception appears somewhat strange initially, it needs to be seen in the context of a dominant 'positivist' ethos of the time. Keats was suggesting that poets with originality, flair and creativity (one assumes like him) operated with such negative capability. The essence of 'man' (sic) being *capable* and being in *uncertainties* is the key element of this exposition. Today's definitions and usage of the singular *capability* also resonates extremely strongly with this aspect (Cairns and Stephenson 2009).

The definition of capability has a number of variations (though one could suggest, not as many as competence). The most frequently used and cited include the singular *capability*, which has been utilised across a wide range of educational, business and other areas as a theorised and well-defined term suggesting potential (Stephenson and Yorke 1998; Cairns and Stephenson 2009).

In this version of the capability concept, the term has been defined as:

> Capability is an all round human quality observable in what Sir Toby Weaver describes as 'purposive and sensible action' (Weaver 1994). Capability is an *integration* of knowledge, skills, personal qualities and understanding *used appropriately and effectively*-not just in familiar and highly focused specialist contexts but in response to *new and changing* circumstances. Capability can be observed when we see people with justified confidence in their ability to:
>
> - Take effective and appropriate action;
> - Explain what they are about;
> - Live and work effectively with others; and
> - Continue to learn from their experiences as individuals and in association with others, in a diverse and changing society. (Stephenson and Yorke 1998, p. 2)

In the recent comprehensive account of the past 25–30 years of *capability* theory, research and application (Cairns and Stephenson 2009), the development and theorization of the concept is detailed and the following definition is specified:

> Capability is a holistic concept which encompasses both current competence and future development through the application of potential.
>
> The concept is applicable across both individuals and organisations.

Capability involves:

the capacity to operate in both familiar and unfamiliar situations
the utilisation of creativity and imagination/innovation
being mindful about change and open to opportunities or uncertainties
being able to engage with the social values relevant to actions
engaging with learning as a self-directed process
operating to formulate and solve problems

Capability as a concept is therefore holistic and involves a range of elements and processes and as such needs careful consideration and understanding if it is to be applied to Capable people, organisations and processes implemented in Education, Business and Training. (Cairns and Stephenson 2009. p. 16–17)

5.3 Sen and Nussbaum's *Capabilities*

The plural variation of this term, *capabilities*, has arisen within the welfare, social justice and equity literature and has been popularised by Sen and Nussbaum (Sen 1985, 2009; Nussbaum 2011). This approach, as most recently explicated by Martha Nussbaum in her 2011 book, *Creating Capabilities*, in which she sets out the 'approach' (as described and detailed by her) as:

The Capabilities Approach can be provisionally defined as an approach to comparative quality-of-life assessment and to theorizing about basic social justice. It holds that the key question to ask, when comparing societies and assessing them for their basic decency or justice is, 'What is each person able to do and to be?'.(p. 18)

Amartya Sen offers a slightly different variation on what he calls the *capability* (singular*) approach*:

In contrast with the utility-based lines of thinking, individual advantage is judged in the capability approach by a person's capability to do things he or she has reason to value. A person's advantage in terms of opportunities is judged to be lower than that of another if she has less capability-less real opportunity- to achieve those things she has reason to value. (Sen 2009, p. 231)

Nussbaum, in her 2011 work goes on to suggest that 'Sen's primary concern has been to identify capability as the most pertinent space of comparison for purposes of quality-of-life assessment, thus changing the direction of the development debate' (2011, p. 19). She adds (p. 19 ff), that 'In consequence, Sen does not employ a threshold or a specific list of capabilities, although it is clear that he thinks some capabilities (for example, health and education) have a particular centrality'.

For Nussbaum, in contrast to Sen, there is a set of ten *central capabilities.* These are listed in her works as:

1. Life
2. Bodily health
3. Bodily integrity
4. Senses, imagination and thought

5. Emotions
6. Practical reason
7. Affiliation. (A) Being able to live with others and (B) having the social bases of self-respect and nonhumiliation
8. Other species
9. Play
10. Control over one's environment: (A) political, (B) material (2011, p. 33–34)

The level of generality and dispositional quality amongst these central capabilities is apparent and the breadth of these as an idealist social justice conceptualization is evident. That some of the listed *central capabilities* are such expressions as 'other species' and 'play' does little to offer those examining this 'approach' as well theorised and defined aspects. The theory basis and application of the Sen and Nussbaum conceptualization is broader than the Education for Capability concept drawn upon in this chapter. The latter has been further developed through the 1980s till the present, and its application across many fields of education, training and organisational development has been extensive as will be exemplified below.

That Sen and Nussbaum have collaborated, yet taken slightly differing approaches and definitions of the approach can be seen from a scrutiny of their writing. As Nussbaum has written:

> These are the essential elements of the approach. It has (at least) two versions, in part because it has been used for two different purposes. (2011, p. 19)

Whilst the Sen and Nussbaum ideas around the various capabilities they have enunciated and discussed have made an impact across economics, social justice and international understanding relating to welfare, life and educational opportunities and equity, the difference between this approach and the RSA initiative under the singular *capability* banner has led to quite different applications and development (see Seddon and Cairns 2002 and Cairns and Stephenson 2009, for comparative discussion).

The genesis and development of the *capability* concept as espoused in the tradition of the RSA *Higher Education for Capability* approach, as mentioned above, has been well documented in the 2009 book, Capable Workplace Learning (Cairns and Stephenson), which sums up over 25 years of theory, research and application of this concept across a wide range of educational and organisational entities as well as across individuals.

The following sixteen examples of the application and research base for the advancement of this *capability* approach offer a selection of the breadth of work in this genre:

1. An examination of organisations via case studies across a number of Australian industries to explore whether the theorised capable organisation idea was manifest and to know what were the characteristics of such entities (Hase et al. 1998).
2. A study in the UK as to what aspects of organisational and corporate capability were evident and contributing to organizational effectiveness based on developments from the competency-based NVQs (Williams et al. 1998).

3. A case built to establish the merits and characteristics of the capable professional (O'Reilly et al. 1999).
4. The linking of capability and wisdom as key elements in the approach to strategic learning (Cunningham 1994).
5. Building a model of how capability in technical and further education offers a sophisticated approach to professional development and practice in VET for the 'knowledge era' as well as the development of 'life-based learning' as part of a capability development model for business (Staron et al. 2006a, b).
6. A research PhD examining the peace-keeping needs and experiences of the Australian army operating in the name of the UN in African nations which developed into a capability model based on the Stephenson work in Higher Education for Capability (Schmidtchen 1997).
7. Developing the capable teacher in a capable school (Cairns 1998a, b, 2001).
8. Drawing on the capability model to develop ideas and agenda for vocational education and training and workplace learning (Malloch and Cairns 1999; Malloch et al. 1998; Hughes and Cairns 2013).
9. Applying the capability model to aspects of international management and intercultural awareness (Townsend and Cairns 2001, 2002, 2003).
10. Capable workplace learning (Cairns and Stephenson 2009).
11. Capability in leadership (Seddon and Cairns 2002).
12. Ethnocapability (Townsend and Cairns 2001).
13. Capability in higher education (Stephenson and Weil 1992; Stephenson and Yorke 1998; The University for Industry-Learn Direct Approach, (Stephenson and Saxton 2005).
14. Capability in the health industry which draws on the capability model as espoused in this chapter to argue a case for moving beyond competence in the UK National Health Service (Fraser and Greenhalgh 2001).
15. An examination, as part of a major national project of 'approaches to reviewing staff capability towards flexible learning and the use of technologies to achieve business objectives in VET' in Australia which drew on the definitions of capability and the capable organisation discussed in this chapter as its informing ideas (Renshaw-Hitchen and Associates 2000).
16. A study of advanced nursing practices (especially in midwifery) indicated that 'This study suggests that both competence and capability need to be considered in understanding the complex role of the nurse practitioner' (Gardner et al. 2008).

The ideas and applications across so many fields of the underpinning concepts and theories associated with the RSA derived and developed view of *capability*, as applied with regard to education and training in particular, have not gone without some critical reaction. Writing in 1984, when the approach was emerging in the UK, Thompson offered a vigorous critique of the RSA *capability manifesto* and argued that there were a number of shortcomings and aspects of what he termed 'the capability movement'. Thompson's critique, which had been first presented at a conference organised by the higher education group, suggested that '(t)he proponents of

Education for Capability had presented a case which seemed to me to be a mixture of tautology and 'progressive' educational thought' (p. 203). He did offer a number of specific criticisms about the style, philosophy and language of the *manifesto* and the implications for education and training differences and the ideas surrounding 'skills' in the economy but did concede near the end of his paper that '(t)he thrust of the proponents of 'Education for Capability' is in many respects admirable and their good intentions are unquestioned'. However, he still faults the concepts and ideas as unable to 'bear the load placed upon them' (p. 212).

The refinement and elaboration, as well as the many applications of the *capability* idea and theory, along with additional research, have shown the robust nature and rigorousness of this concept as espoused by its many advocates. That *capability*, as set out in this chapter, has had a major positive influence on education, TVET and business, and industry shows that the concept, as one workshop participant many years ago in Australia suggested in the local idiom, 'has legs'.

5.4 The Transition from Competence to Capability and Links to Graduate Attributes

Recent further developments across Australia, Europe and other countries have seen a shift beyond the former somewhat simplistic notion of competence as a behaviouristic approach that defined competence, competencies and competency (virtually using all three of these terms interchangeably) as observable behaviours where there were clear demonstrations of the defined behaviours to a specified industry agreed standard. The shift, over the past decades in countries such as Australia and New Zealand has moved the ideas and conceptualization of competence to a broadening of the definition and the addition of qualifiers to the term. What has emerged are described as *key competencies* (in Australia see the two Mayer reports in 1992 for the genesis of this shift), and this approach has similar resonances in Europe and the Americas.

Interestingly, the OECD also moved the debate about the defining of competence and competencies into the arena of *key competencies* (Rychen and Salganik 2000) as did Cedefop in its shift towards 'Learning Outcomes' (Cedefop 2009) where the differing models and approaches to defining and applying 'competence' across the '32 European countries' with regard to education and training were discussed in some detail (p. 12). Cedefop, in that report, went on to recommend that the term *learning outcomes* offered a broad yet clear meaning as distinct from competence or the many variations upon that term:

> The problem is that the term *competence* (as well as competences and competencies) lacks a clear, standard meaning both in the English language and across European language traditions. Once we introduce the term competence, definitions become fuzzy at best, and there is no way to place a single discipline or definition on it. It is now widely accepted that, for example the terms competence, *compétence*, and *Kompetenz* each have rather different connotations in their respective language and cultural traditions. (p. 19)

Whilst the debate is something of a semantic issue to some, the evident gradual shift towards more holistic or encompassing terms, as argued in the capability debate in the UK, Australia and New Zealand, has gained some traction across many differing domains in education and training.

The German work in vocational education and training discussed above by Felix Rauner and his colleagues in the Institut Technik und Bildung (ITB) in Bremen University is one example where the competence ideas have developed into a set of different elemental competencies arranged more or less hierarchically as four stages of development. Rauner in his research group and model (COMET) has argued for a broader conceptualization of *professional competence*, which covers knowledge, skills, attitudes and values linked to the development of a professional identity as a 'complete' professional activity model of action and development. Emphasis on holistic problem-solving and operational capability in this approach is presented as a four-stage model.

The four stages are:

1. Nominal scientific and technological competence
2. Functional competence
3. Processual competence
4. Holistic shaping competence (Rauner et al. 2013, p. 164)

For Rauner, the *holistic shaping competence* is described in the following manner:

> (A)t this level of competence, occupational tasks are considered in their full complexity with due regard to the diverse operational and social conditions in which they are performed and to divergent requirements in terms of the work process and its outcome. (p. 164)

The idea that a more holistic conceptualization associated with the term *competence* should be seriously considered, particularly with regard to the development of professional identity and roles, has gained ground with a number of other writers, committees and reports (Beckett 2008; Cheetham and Chivers 1996; Bolderston 2007).

Educators in particular have been critical of the way the competency-based education and training narrow conceptualization has left out considerable elements of the world of learning and achievement by students (Cairns 1992).

In Australia, the national peak organisation of University Deans of Education, the Australian Council of Deans of Education (ACDE), in a submission to the Australian Government Independent Productivity Commission argued that study at a higher-education level equips students with capability that is not necessarily obtained through competency-based qualifications:

> … learners whose understanding of a job role is developed in a competency-based program will not necessarily achieve a grasp of the principles and ways of thinking that underpin competent performance … higher education facilitates development of a holistic understanding of the discipline or industry area and a critical appreciation of how and when to apply theoretical knowledge in particular contexts. (sub. DR107, p. 10) (Australian Productivity Commission Report 2011, p. 275)

As part of his ongoing publications of the terminology and broadening philosophy of competence in the Dutch context, Mulder and his colleagues offered a suggestion that a 'new competence' should replace the old behaviouristic version (Mulder et al. 2009). This paper clearly suggests that in the higher education sector, a broader definition and understanding of competence are needed. This study across a number of senior academics in universities in the Netherlands suggested that:

> But if competence is perceived as capability, the universities and academies have since their inception contributed to the development of competence of their students, for it has always been the purpose of these institutions to educate students to be able to fulfil a role in society. In the course of centuries university education however has become over specialised and fragmented. Specialised knowledge became most important. (p. 761)

The emergence of further disquiet with the 'old competence' idea (to use Mulder's term), within discussions of the needs of the professions and higher education contexts, resonates with the case built over many years in the Higher Education for Capability work led by Stephenson in the UK and developed from that in Australia and New Zealand in particular (Stephenson and Weil 1992; Cairns 1992: McKay and Heinrich 1997).

The idea that there was more to both education and training than merely meeting a set of competency standards has been neatly emphasised by Wheelehan (2009):

> CBT's simplistic and atomistic notion of skill is what allows current state and Commonwealth government policy in Australia to insist that apprenticeships can be shortened. However, learning how to become a member of a trade, occupation or profession is not simply a matter of meeting all the specified learning outcomes, particularly when these are tied to specific tasks or roles. The holistic development of the person in the context of their profession is excluded, and this involves for identity as part of that profession. This cannot be easily codified as observable outcomes tied to specific skills. (Wheelahan 2009, p. 237)

In the Introduction to their book, *Capable Workplace Learning*, Cairns and Stephenson (2009) noted that the significant Australian government commissioned National Review of Higher Education made a telling point with regard to competence and capability:

> Quite recently, whilst we were preparing this book, the Australian government's commissioned *Review of Australian Higher Education* was released in 2008 (Bradley, Chair). It is interesting and possibly significant for the case made in this book that the report notes, in clarifying its definition of the function of Higher Education, the following point (footnote 3, page 6):
>
> In the discussion Paper, a core function of contemporary higher education was identified as 'Developing high level knowledge and skills'. There is general agreement that there is a third component of educated performance which involves a broader element variously described as understandings, capability or attributes. This element permits the individual to think flexibly or intelligently in situations which may not previously have been experienced. Often value positions, including a commitment to lifelong learning or to responsible citizenship, or the insights derived from practical experience are seen to be components of this. (Cairns and Stephenson 2009, p. x)

Stephenson, in 2001 and earlier (Stephenson and Yorke 1998), had also developed an approach to higher education work, especially focused on students managing

their own learning through what he described as a *Capability Envelope* which he labelled as a 'holistic approach' (Stephenson 2001).

These points lead us to consider the more recent development of the ways learning outcomes of the various levels of educational systems and institutions are being described and codified.

5.5 Graduate Attributes or Learning Outcomes

The matter of attempting to document and codify the types of outcomes any learner should achieve, demonstrate or be able to exhibit in some way has been a longtime goal of most education and training systems worldwide. The genesis of much of the aforementioned competency-based education and training approaches was related to attempting to better enable and clarify what an education and/or training national system was intending to produce from its activity in society. The so-called outcomes education emerged in a variety of forms ranging from the previously mentioned narrow behaviouristic patterns to more broad-based ideas about such aspects as 'employability' for school and education systems at all levels. This approach to specification differed from the older traditions of 'aims' or 'goals' of educational systems.

5.5.1 An Evolutionary Movement Towards Learning Outcomes

We have argued in this chapter that there has been a gradual development and refinement of concepts, on the one hand, and a broadening of the notions surrounding learning outcomes as a consequence of educational experience, on the other hand, in the past twenty years, where sets of specific 'skills', certain listed 'knowledge' and expressions of possible and valued 'attitudes' (the KSA of education and training) were spelled out in a range of ways in curriculum documents, government reports and various reviews of schools, training programmes and in higher education, all focused on the outcomes for the students who passed through the systems.

This influence is evident in many national curricula for schools (e.g. the Ministry of Education, Singapore, where there is an advocacy of 'twenty-first-century competencies' which are described as 'life-ready competencies like creativity, innovation, cross-cultural understanding and resilience' (MOE 2014) and in the expression of expected outcomes across many colleges and universities. A brief perusal of college and university websites internationally shows that most have specified learning outcomes (USA) or graduate attributes (UK, Australia, New Zealand).

A popular expression of what have become known as '21st Century Skills' has been presented by the two US authors, Trilling and Fadel in their 2009 book, which has the subtitle 'Learning for Life in Our Times'. Trilling and Fadel (2009)'s

approach is to suggest a set of twenty-first-century 'learning outcomes' under three groupings: learning and innovation skills, digital literacy skills and career and life skills. Allied with these groupings in their final appendix presentation are '7 Cs' (seven terms each commencing with the letter C) which cover aspects such as critical thinking and problem-solving, collaboration, teamwork and leadership, creativity and innovation, cross-cultural understanding and so on. (It is interesting to refer to the interview with one of the founders of the UK *Education for Capability* approach at the RSA, Sir Toby Weaver, reported in Cairns and Stephenson (2009, p. 8.) where he used six words, all beginning with C and considered adding a seventh to encapsulate the idea of *capability.*)

As Hager and Holland (2006), in their comprehensive book on this aspect, define the scene in their Introduction:

> In an international context there has been increasing educational attention paid to what are variously called 'generic skills', 'core skills' or 'basic skills', or, more recently, 'employability skills'. Sometimes they are referred to as 'competencies' rather than as 'skills'. The term 'generic skills' and its cognates are widely used to refer to a range of qualities and capacities that are increasingly viewed as important in all walks of life, though the main focus is usually on their role in work and in education viewed as a preparation for work. Typical 'generic skills' cluster around key human activities such as communication, working with others, gathering and ordering information, and problem solving.
>
> This contemporary focus on generic skills has spread across education systems, including the university sector, where they are often called 'graduate attributes' or 'graduate qualities'. For the purposes of this book, we will use 'generic attributes' as the meta-level, more encompassing term to refer to these 'skills' or 'competencies'. When we are referring specifically to the higher education sector, as will be the case for much of this book, the preferred term will be 'graduate attributes'. (Hager and Holland 2006, p. 2)

5.5.2 Graduate Attributes as Outcomes

It has become, in recent times, increasingly common for tertiary education institutions in some Western nations to introduce 'graduate attributes' in which graduates are expected to be able to demonstrate by the time students have successfully completed their course of study. The graduate attributes typically specify knowledge, skills and attitudes to be achieved. Within this trend, there appears to be an agenda to build a bridge between study and the world of work with the individual achievement of attributes useful to potential employers.

The terminology mentioned here, of *graduate attributes*, is common to the tertiary sectors in the UK, Australia and New Zealand, whereas the term *learning outcomes* figures in most US universities. Essentially, graduate attributes, also identified frequently in some nations as key, core or generic skills or attributes, have been introduced into the tertiary education sector over the past two decades (Barrie 2006; Bowman 2010). With mass higher education, and development of a knowledge society, there has been a demand for higher qualifications and along with subject specific qualifications, demonstration of achievement of transferable or generic

skills (Aamodt and Hovdaugen 2008). Down (2006) identified the impetus from industry and the professions for work-ready new employees with assessed and reported outcomes. No longer could it be assumed that such skills would develop from taking part in a course of study.

She lists common graduate capabilities specified in tertiary education institutions:

- Knowledgeability
- Employability
- Creative thinking
- Critical analysis skills
- Information literacy
- Environmental sustainability literacy
- Leadership and global and domestic citizenship (Down 2006, p. 201)

The use of the plural term 'capabilities' also became a part of the confused territory of graduate attributes, albeit that this list is more comprehensive and embracing than other examples. For vocational education and training, generic skills include 'communication, problem solving, planning and organising, innovation, working with others, employability and self-management' (Down 2006, p. 201) The development of such lists of skills or graduate attributes to be achieved is identified as a first step to an outcomes form of assessment in the tertiary education sector, nevertheless isolated from understandings of the relationship between learning and work.

5.5.3 Outcomes in Qualification Frameworks

National qualification frameworks have been developed over the past three decades providing, by level of qualification, lists of the skills, knowledge and learning outcomes to be demonstrated. In the Australian Qualifications Framework, for example, the focus on generic competencies and outcomes to be achieved in education and training emphasises the acquisition of knowledge, skills and the application of these.

> Generic learning outcomes are incorporated into qualifications in the development process and their application is specific to the education or training sector.
>
> Generic learning outcomes are the transferrable, non discipline specific skills a graduate may achieve through learning that have application in study, work and life contexts. The four broad categories of generic learning outcomes recognised in the AQF are:
>
> - fundamental skills, such as literacy and numeracy appropriate to the level and qualification type
> - people skills, such as working with others and communication skills
> - thinking skills, such as learning to learn, decision making and problem solving
> - personal skills, such as self direction and acting with integrity.' (AQF 2013, p. 11)

5.5.4 Graduate Attributes in Higher Education

In the higher education sector, similarly, concern for the attributes or key or core skills that graduates take from their studies to the workplace led to the development of graduate attributes across a number of universities in Australia. Examples of such specifications come in different degrees of complexity and coverage.

Monash University, Australia's largest and one of the prestigious groups of eight major research universities in Australia, has the following set listed on its website (WWW.Monash.edu):

> The Monash Graduate Attributes are consistent with the University's strategic aspirations, as set out in *Monash Directions 2025* and the Academic Plan, and reflect the vision of Sir John Monash that individuals should develop themselves not only for their own benefit, but for the benefit of the community [1923]. They underpin Monash's coursework courses.
>
> Monash University prepares its graduates to be:
>
> 1. responsible and effective global citizens who:
>
> (a) engage in an internationalised world
> (b) exhibit cross-cultural competence
> (c) demonstrate ethical values
>
> 2. critical and creative scholars who:
>
> (a) produce innovative solutions to problems
> (b) apply research skills to a range of challenges
> (c) communicate perceptively and effectively

The University of Sydney, in Australia, the nation's oldest university and also one of the 'group of 8' major research institutes, offers an even shorter version:

> Graduate Attributes are generic attributes that encompass not only technical knowledge but additional qualities that will equip students to be strong contributing members of professional and social communities in their future careers. The overarching graduate attributes identified by the University relate to a graduate's attitude or stance towards knowledge, towards the world, and towards themselves. The development of these attributes is explicitly focussed on in teaching and assessment in students' formal courses of study at the University. This second level of attributes is described as five clusters of more specific attributes;
>
> 1. Research & inquiry
> 2. Information Literacy
> 3. Personal and Intellectual Autonomy
> 4. Communication, and
> 5. Ethical Social and Professional Understandings
>
> http://www.itl.usyd.edu.au/graduateAttributes/unipolicy.pdf

The move to specify and codify in documents, websites and so on across schools, universities and colleges, such expected outcomes for student learning is almost universal in this twenty-first century and represents an approach that is generally taken for granted as a necessary element of any education of training institution.

The key issue for this chapter is the nature and underlying theory and research that informs the format, terminology and content of any such specification. Our discussion has highlighted the case that whilst the starting point in many countries was a narrow focus of definition and application of competency-based ideas for education and training, there has been a well-documented iterative shift towards a more broad-based concern for a more holistic approach.

5.5.5 Clarifying Graduate Attributes as Educational Outcomes

Hager, writing the major initial theoretical and definitional chapter in his work with Holland in 2006 on graduate attributes, offered a critique of the 5 'conceptual errors', 'common misunderstandings' or 'mistakes' that have been prevalent across the world about just what and how graduate attributes are conceived of and expected to be acquired and applied by graduates of schooling, university degrees and training programmes. The five conceptual errors are listed as:

I. That they are viewed as *discrete or atomic entities*, thus they can be acquired and transferred singly.
II. That the learning of each of them is thought to be a relatively quick, once-off event. They are *acquired complete and finished* (this follows on from I).
III. That they are thought of as being acquired by *individual* learners. So the learning is located within individuals. (This view is often linked with I, but is actually not at all entailed by it).
IV. It is thought that we can *readily recognise them* when we see them. (It is easy to conclude from I and II that if typical generic attributes are discrete entities and can be acquired readily, then it must be straightforward to identify when someone exhibits them).
V. It is thought that they are *readily and unequivocally describable in language*. Hence it is straightforward to develop descriptive understandings of typical generic attributes and to convey these understandings to others in written form. (V may seem to follow from IV, but this is not the case, as will be shown below). (Hager and Holland 2006, p. 18).

Hager's point is that a more holistic and different perspective is needed in considering the what and how of graduate attributes. He offers a further set of five 'principles for gaining a more accurate understanding of the nature of graduate attributes'. These are listed as:

I. Viewing learning as a process.
II. Paying due regard to the holism of generic attributes.
III. Taking proper account of the influence of social/group factors.
IV. Recognising the contextuality of generic attributes.
V. Recognising the relevance of generic attributes for lifelong learning.

Elsewhere in his chapter, Hager discusses, in some detail, many of the attributes frequently specified and offers a number of suggestions as key ideas. Throughout the exposition is the reiteration of the need for a more holistic view. We suggest that

the aims and elements of what we have described and elaborated on in this chapter are not dissimilar to this near to last point by Hager:

> It is also crucial that generic attributes should be thought of more broadly than in terms of just university and work. These attributes represent a basis for lifelong learning in all kinds of life situations. Rather than being viewed as discrete attributes that people learn to transfer, generic attributes should be seen as learnt capacities to handle an increasing variety of diverse situations. Thus transfer becomes more a growth in confidence and adaptability as learners experience ever more success in their deployment of generic skills in a range of situations. To put it another way, perhaps it is not so much generic attributes that transfer, as growing understanding of how to deal with different contexts. (p. 43)

The brief overview of the development of competence and capability provided in this chapter and their relationship to higher and vocational education and training demonstrates the confusion and uncertainty as to the terms employed in the attributes identified for graduate achievement, nor is there national or international agreement on such lists with their featuring in mission statements, curriculum and quality audits and strategies in relation to graduate attributes (Barrie 2006; Barrie et al. 2009). Competence and capability are utilised frequently in such lists of attributes interchangeably, which we suggest is not helpful for the understanding and differentiation of the terms. We have presented a clear and supported case for the concept of *capability* to stand as a unique term.

As discussed in this paper, in Anglophone tertiary education, the trend in graduate attributes has been to utilise an approach informed by competence. As noted by Holmes, an assessment of competence is assessment of what *has been* achieved; capability is more future oriented (1995a). From the examples above, efforts are being made to approach graduate attributes with consideration of learning, especially in relation to the what, how and where. Teaching styles, modes of delivery and assessment are also focused upon. Enabling a contribution by students and teachers as stakeholders to the development and implementation of graduate attributes is also supported. These developments contribute to the consideration of different models; for example, Green et al. (2009) raise the possibility of a holistic embedded model with a whole-university approach to planning and implementation of graduate attributes. The idea of moving towards a *capability* approach that encapsulates many of the models and features and which has been well documented in the UK through the *Higher Education for Capability* projects is apparent.

The development in recent years of concern with such world-wide issues such as sustainability has also contributed or given rise to arguments for different types of graduate attributes/capabilities and raised questions about how these concepts might be clarified (Barth et al. 2013).

With such a range of challenges, there is no doubt that this debate will endure and move through additional iterations and conceptualisations over the twenty-first century.

5.6 Conclusions

The development of graduate attributes, competencies, capabilities and learning outcomes has evolved throughout the twentieth and early twenty-first centuries with discussion and debate in attempts to clarify the terminology, purpose, development and implementation of education in formal institutions. With increased massification of higher education, and the almost universal emphasis through the quality agenda on the accountability of universities, the focus has been on measuring the outcomes of teaching accompanied by an increasingly vocational emphasis as to achieving employment outcomes for graduates. There is, however, also the expectation that graduates will develop personally and will be capable to operate with intelligence beyond their learning in formal courses (Kember and Leung 2005). This agenda expands upon the existing requirements for competence and seeks capability held by professional bodies for new entrants in such fields as law, accounting, engineering, teaching and nursing.

Increased numbers of students, and demands for higher qualifications which facilitate the gaining of both subject-specific and transferable or generic skills ostensibly required by employers, are very much a part of an agenda of accountability of TVET institutions, universities and their staff.

The development of graduate attributes in many cases is a top-down exercise concerned with assessment of outcomes regarded as desirable for potential and possible employment. Such an approach also makes assumptions as to the transferability of the learning in the college and university programmes to the world beyond. It is argued that an emphasis on competence to be demonstrated in graduate attributes or outcomes has been conceived narrowly particularly in Australia and in other Anglophone cultures. Generally, the graduate is assessed for both their qualification and for the world of employment. Canada, Australia, Brazil, Mexico and the USA do share some commonalities in relation to identified generic skills, occupational competencies and domain-specific knowledge and skills (Nusche 2008). Assessment of narrowly described attributes can be countered by consideration of more creative aspects so that the capability of the individual can be focused upon (Holmes 1995b).

We have argued, in this chapter, that the conceptualisation, theorised and researched idea of *capability* which we have presented in this work, offers a broad-based yet applicable idea/approach for the twenty-first-century learner and that it has been utilised across a wide range of situations and industries to effect a useful and practical set of results.

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Chapter 6
Using an Epistemological Perspective to Understand Competence-based Vocational and Professional Education

Richard G. Bagnall and Steven Hodge

6.1 Introduction

Competence-based approaches to vocational and professional education remain internationally ascendant, despite the weight of critical argument against them. In this chapter, an epistemological analytic framework is used to illuminate that situation. The analysis begins with a brief historical account of the contemporary flourishing of competence-based vocational and professional education, before introducing the notion of epistemologies and their relationship to educational policy and practice. We then apply that epistemological framework to illuminate the situation, arguing that competence-based education evidences an instrumental epistemology, which is significantly incommensurable with the disciplinary, constructivist and emancipatory epistemologies in which telling criticism of it is grounded. The resilience, then, of competence-based education to such criticism may be understood as being a function of the singular compatibility of its informing instrumental epistemology with the contemporary cultural context of globalising performativity, in which the contribution of vocational and professional education to enhancing comparative competitive economic advantage emerges as the driving criterion of value. We then speculate on the implications of the analysis for the future form of vocational and professional education policy, practice and research and on the place of competence-based education in that future.

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6.2 The Historical Context

Contemporary competence-based approaches are agreed to have emerged in systematic form in the context of American Cold War education policy (Harris et al. 1995). The launch of Sputnik by the USSR was taken by US policymakers as a sign that their education system was failing to produce the science and technology innovators required for national triumph in the space race. One of the elements of that problem was identified as being the professional preparation of teachers, so a national programme was instituted to improve teacher education (Hodge 2007). 'Performance-based teacher education' (PBTE) – later called 'competence-based teacher education' (CBTE) – emerged as a response to the perceived malaise. PBTE was heavily influenced by behavioural psychology, in its emphasis on the specification of learning objectives and on learning assessment in terms of observable behaviours. From the early implementation of such approaches through to present-day competence-based policy and programmatic initiatives, they have generated a steady stream of criticism, through a range of arguments, including their inability to capture crucial qualities of performance (Broudy 1972), their dehumanising of important learning (Mezirow 1978), their theoretical incoherence (Hyland 1993), their inherent inability to achieve their own goals (Ashworth and Saxton 1990), their complicity in the disempowering of workers (Edwards and Usher 1994) and their formalisation of power hierarchies (Field 1991).

In spite of the persistence, sophistication and telling nature of that criticism, competence-based education has continued to be promoted in vocational and professional contexts. During the 1980s, it was taken up by neoliberal governments, who came to view education and training systems as potential contributors to national economic performance (Moore 1987). A formula for harnessing vocational education systems in particular to economic policy goals had been articulated by economic theorists, arguing that employers need to be given a central role in determining vocational curriculum and offering models for achieving that end (Finegold and Soskice 1988). Because competence-based education allows the formulation of curriculum aims to be separated from the implementation of the curriculum, it presents a model of educational practice open to giving employers a leading role in curriculum development. It has since then flourished in national systems of 'skill formation', articulated in programmes of vocational and professional education policy reform throughout the world (Winterton and Haworth 2013). Why, then, has the continuing, telling stream of criticism been so ineffective in stemming that flourishing?

6.3 Informing Epistemologies: An Alternative Perspective

We are here articulating a response to that question by focusing attention on the different epistemological traditions, or epistemologies that are evident in both competence-based vocational and professional education, and the educational perspectives in which strong criticisms of it are grounded.

In so doing, we are adopting the conventional meaning of 'epistemology' to identify the discipline of inquiry that is focused on the philosophical study of knowledge: what knowledge is and how it is generated, learned, taught, assessed and used (Sulkowski 2013). Epistemological inquiry has traditionally identified and focused critical attention on a diversity of different conceptions of what constitutes knowledge – of what it actually amounts to – including coherentist, foundationalist, pragmatic, naturalistic, relativist, positivist, realist and critical realist conceptions (Abel 2011). These different conceptions of knowledge may be seen, then, as constituting distinctive, substantive accounts of the nature of knowledge – as what may be termed different *epistemologies.*

Such epistemologies are certainly important in education, particularly in educational research (Brown and Baker 2007). In educational policy and practice, though, attention has traditionally been focused, not so much on the nature of knowledge, on *what is important in the act of knowing*. Such attention introduces a *normative* element into the recognition of different epistemologies – that of what is humanly *important*. That normativity recognises that the epistemologies capture the cultural constraints and restraints informing educational practice, including that of vocational and professional education, in defining what *should* be done and should be the case in those cultural practices (Hansen 2007). Correspondingly, the epistemologies defined in this way are different from those defined by traditional philosophy. In educational scholarship, they have commonly been presented as elements of different *philosophies of education* (Elias and Merriam 2005), but our concern in this chapter – with the epistemic features of those philosophies and the educational implications of those features – leads us to use the more accurate notion of *epistemologies*. For our purposes here, we may recognise four such conceptions of knowledge, that is, conceptions of what is important in the act of knowing: knowledge as truth, knowledge as authentic commitment, knowledge as power and knowledge as effective action. Each of those conceptions is seen as defining an epistemology: knowledge as truth defining *disciplinary* epistemology, knowledge as authentic commitment defining *constructivist* epistemology, knowledge as power defining *emancipatory* epistemology and knowledge as effective action defining *instrumental* epistemology. The recognition of these four epistemologies seeks to capture the substantial majority of published judgements about the value of competence-based vocational and professional education, whether for it or against it.

Each epistemology captures distinctive approaches to the development of new knowledge, to learning and to using knowledge, as well as a distinctive view of how that use contributes to human well-being (Williamson 2000). Each thus captures (normatively) the constraints for educational policy and practice to have a distinctive form, to exhibit distinctive characteristics, if it is to be judged to be of good quality. In particular, it will emphasise particular ways of thinking about education over others, and it will require particular aspects of educational policy and practice rather than others – including criteria for assessing educational attainment. These educational characteristics are thus captured in different *approaches* to education: each epistemology explaining the commitment to a closely related cluster of approaches evidencing those characteristics and each epistemology providing the arguments *for* each approach.

The epistemologies are implicit in the historically cumulative body of scholarship in education. However, they align only partly with traditionally recognised epistemologies, with, for example, logical positivism (Hanfling 1981) historically falling into what is recognised here as disciplinary epistemology, although the latter is now substantially critical realist (Archer 1995), and critical realism is also influential in what are here presented as the constructivist and instrumental epistemologies. What is recognised here as emancipatory epistemology, though, is closely aligned with traditional epistemic relativism (Muller 2000). It should also be acknowledged that the epistemologies here recognised have long been evidenced in the recognition of practical philosophical approaches to education, such as those of an 'academic', 'critical', 'humanistic', 'progressive', 'radical' or 'practical' nature (Elias and Merriam 2005).

Although the recognition of these four epistemologies is firmly grounded in educational scholarship, their articulation to date has been fragmentary, and hence their implications for our understanding of the value of competence-based vocational and professional education have not been recognised or systematised as we are attempting to do here. Our purpose, then, in focusing on the four epistemologies in this work is to sketch their normative features in vocational and professional education and to examine how those features may inform our understanding of the value of competence-based vocational and professional education.

6.4 Disciplinary, Constructivist, Emancipatory and Instrumental Epistemologies

The following brief outline of each epistemology sketches, firstly, selected key epistemic features: its conception of knowledge; how new knowledge is developed, learned and used; and how knowledge is seen as contributing to human well-being. Selected normative characteristics of educational theory, policy and practice evidencing the epistemology are then outlined: its educational focus and teleology, its criteria for assessing educational attainment, the sort of knowledge sought in its educators and contemporarily significant educational approaches developed through it. A selective summary of that material is presented in Table 6.1.

6.4.1 Disciplinary Epistemology

At the core of disciplinary epistemology is a view of knowledge as truth about reality (Abel 2011). Such knowledge thus tends to be propositional and theoretical in nature. Its generation focuses on the objective, disciplinary discovery of theoretical knowledge through discrete academic disciplines (Archer 1995). Likewise, the learning of disciplinary knowledge is through the study of disciplinary bodies of

Table 6.1 Selective features of the framework of educational epistemologies

Epistemology	Epistemological and educational features					
	Conception of knowledge	Contribution to well-being through	Educational focus	Educational attainment assessed as	Valued educator knowledge	Educational approaches
Disciplinary	Knowledge as truth	Wisdom	Immersion in disciplinary knowledge	Mastery of bodies of knowledge	Disciplinary expertise	Liberal
Constructivist	Knowledge as authentic commitment	Character formation	Immersion in authentic experiences	Achievement according to models of human development	Character as persons	Progressive
						Humanist
						Problem centred
						Student centred
Emancipatory	Knowledge as power	Emancipation	Immersion in social criticism and action	Conformity to the framework	Commitment to the emancipatory framework	Critical
						Radical
						Transformative
Instrumental	Knowledge as effective action	Capability development	Engagement in routines	Performance of predetermined actions	Expertise in the learning and in the implementing framework	Behavioural
						Outcomes based
						Competence based

knowledge (Hutchins 1968). Using disciplinary knowledge involves its theory-driven application (Mulcahy 2009). Disciplinary knowledge is thus seen as contributing to human well-being through the wisdom of what is right, good, true and beautiful and of how reality actually works itself leading to human action for the individual and greater good (Collier 2004).

Education evidencing disciplinary epistemology focuses on the immersion of learners in the theoretical content of academic disciplines as bodies of knowledge (Hirst and Peters 1970). It is directed to the development of enlightenment through the depth and breadth of individual understanding in those disciplines. Criteria for assessing educational attainment are strongly focused on learners' mastery in understanding, interpreting, interrelating and manipulating disciplinary content through language and numerical symbolic systems (Barnett 1994). Educators (as teachers) are valued particularly for their disciplinary or content expertise and are seen importantly as transmitting disciplinary content to their students through good teaching and their capacity to reliably and validly assess student learning (O'Hear 1981). The contemporarily significant educational approach that evidences disciplinary epistemology is commonly characterised as being *liberal* in nature (van der Wende 2011).

6.4.2 Constructivist Epistemology

At the core of constructivist epistemology is a view of knowledge as authentic commitment and engagement – authentic in the sense that such commitments are, in some way, true to the nature of humanity and its cultural contexts, across the range of artistic, scientific, individual, social and political endeavour (Dooley 1974). The idea of commitment here entails that which is meaningful in some sense to the subjects, in that it expresses or realises notions or capacities that are valued by them – aesthetically, descriptively, experientially, historically, interactively, scientifically or in other like ways. Such knowledge thus tends to focus on the idea of *being* and to be dispositional in nature. Its generation, correspondingly, may be characterised as the culturally grounded generation of dispositional knowledge (Biesta and Burbules 2003), often negotiated or interactive and drawing upon a wide range of types of human experience and engagement (Alexander 1995). The learning of constructivist knowledge tends to be grounded, reflectively, in the lived experience of situated human engagements or interactions (Fairfield 2009). Using constructivist knowledge tends to follow the same patterns and to be relatively direct in its contextualisation (Rorty 1989). Constructivist knowledge is thus seen as contributing to human well-being by its direct relationship to matters of human concern through the development of character (Blackham 1968).

Education evidencing constructivist epistemology focuses on the immersion of learners in authentic experiences involving their development as persons: in and through interactive educational engagements situated in the cultural contexts of significance to them (Dewey 1966). It is directed to individual actualisation, holistically, through self-knowledge and self-development, socially and spiritually contextualised.

Criteria for assessing educational attainment are drawn from pertinent models of human, social and spiritual development, with appropriate cultural contextualisation (Patterson 1973). Educators, commonly regarded as learning facilitators, are valued for their communicative and social skills and their character as empathic, understanding, encouraging and accepting guides of their students (Valett 1977). Contemporarily significant educational approaches evidencing constructivist epistemology are commonly characterised as being humanistic, progressive or student centred (Howlett 2013).

6.4.3 Emancipatory Epistemology

At the core of emancipatory epistemology is a view of knowledge as power, in the sense that all knowledge is seen as serving a political agenda involving the structuring of relationships between and among categories of persons (Abdi 2006). All knowledge is thus accepted as being relative to the explanatory framework through which it is generated. The generation of emancipatory knowledge involves the construction and elaboration of an explanatory framework of meaning that is paradigmatically radically oppositional to the prevailing hegemonic framework or ideology. The emancipatory framework is thus seen as being totalising or universalising, hence naturally universal (Brookfield and Holst 2011). Learning through it is seen as involving learners' radical conscientisation to the explanatory framework: their transcendence over, or liberation from, the false realities of the prevailing hegemony (Newman 1999). Emancipatory knowledge use follows those same patterns (Hart 1992). The contribution of emancipatory knowledge to human well-being is thus through the emancipation of learners, optimising social, economic and environmental relationships for the greater good of humankind: liberating oppressed persons from the false consciousness and exploitation they have been experiencing under the prevailing hegemonic framework (Monchinski and Gerassi 2009).

Education evidencing emancipatory epistemology focuses on the immersion of learners in social criticism and action (Brookfield and Holst 2011). It is directed to the transformation of learners to living in and through the emancipatory explanatory framework. Such an approach focuses attention, simultaneously, on the weaknesses of the opposing hegemonic framework, as the object of critique and social action, and on the strengths of the emancipatory one, as the source of criticism and social action (McMurchy-Pilkington 2008). The criteria for assessing educational attainment are strictly and straightforwardly dictated by its explanatory framework: they are immanent to it (Brookfield 2005). Educators are valued primarily for their knowledge of and commitment to that framework and their ability to persuade learners to its cause (Illich 1973). Contemporarily significant educational approaches evidencing emancipatory epistemology include those commonly characterised as being critical, radical or transformative, including socialist, feminist and Freirean approaches (Collins 1998).

6.4.4 Instrumental Epistemology

At the core of instrumental epistemology is a view of knowledge as effective action – as the capability to act on and in the world (Bagnall 2004). The ends, though, to which action is directed, are essentially external to the epistemology, being drawn from the prevailing cultural context, rather than the epistemology itself (Bauman 1995). Such knowledge is essentially manipulative in nature, in that it makes it possible to do certain things in particular ways (Bagnall 1999). Its generation focuses on its reductionist elucidation in the context of its effective practice, foregrounding the skills and capabilities – together with their informing understandings, inclinations and propensities – to undertake the otherwise-determined valued tasks effectively and efficiently (Monette 1979). The learning of instrumental knowledge is seen as involving cycles of practice and assessment, undertaken through particular realms of practical engagement – vocations, professions or other domains of human instrumentality (Harris et al. 1995). Using instrumental knowledge involves the appropriate application of the learned skills or capabilities in the proper context of their use, drawing on other forms of informing knowledge (Schecter 2010). Instrumental knowledge is thus seen as contributing to human well-being through enhanced learner capability to more effectively and efficiently attain desired ends valued in the prevailing cultural context (Tuxworth 1989).

Education evidencing instrumental epistemology focuses on learners' engagement in learning routines under specific conditions (Bagnall 1993). It is directed to developing highly valued individual action: highly skilled or highly capable individuals in the case of competence-based approaches (Bagnall 1994). Both the nature of the intended performative attainment and the conditions for its demonstration or display are specified prior to educational intervention (Gonczi et al. 1990). Their specification is commonly achieved by subjecting the external performance goals to formal processes of task analysis (van der Klink et al. 2007). Ideally, the nature and extent of the learning required by each individual learner will also be known prior to educational intervention, so that the intervention may be structured to achieve the desired change with maximum efficiency (Hyland and Winch 2007). Criteria for assessing educational attainment are predetermined by the learning task as being performatively demonstrable and measurable – centrally, skills and capabilities in the case of competence-based education – under the prespecified conditions (Jesson et al. 1987). Educators are valued particularly for their technical expertise, both in the learning task and in learning assessment, task analysis and structuring educational opportunities to achieve desired performance outcomes (Bagnall 2004). Contemporarily significant educational approaches evidencing instrumental epistemology include behaviourist and outcome-based and competence-based education (Elias and Merriam 2005).

6.5 Understanding Competence-based Education

Each of the four epistemologies thus captures an ideal of education as having a particular form: as having particular properties or characteristics. To the extent that any approach to education – competence-based vocational and professional education included – falls short of that ideal form, it is less than properly educational from that epistemological perspective. One approach to evaluating competence-based education from each epistemological perspective, then, is to use as evaluative criteria the differentiating educational qualities captured by each epistemology. Taking that approach here by drawing on the qualities noted in the foregoing articulation of each epistemology, we argue: (1) that competence-based education is straightforwardly *compatible* with the criteria from an instrumental epistemological perspective and (2) that competence-based education is straightforwardly *incompatible* with the criteria from each of the other three contemporarily important epistemological perspectives. We consider the first of these points here and the second in the next section.

That competence-based vocational and professional education is *compatible* with the ends and means of instrumental epistemology is revealed in its focus on equipping learners for competent action in workplace or professional settings (Mulder et al. 2007). In some cases, especially in cases of competence-based vocational education, the ends of this preparation are specified through methodologies that generate specifications of job roles or tasks (Tovey and Lawlor 2004). In other cases, ends are specified in terms of 'generic' competencies, such as interpersonal skills, that are seen as applying across occupations (Biesma et al. 2008). The value of competence-based education at any social level is essentially an economic consideration (Ryan 2011). In all cases, education is tied to external contexts, whether in the form of particular occupations, occupational fields or national policy imperatives. The specification of competencies yielded by occupational analysis may be strictly behavioural or contain cognitive content to some variable extent (Winterton 2009) and is always recorded in the form of textual description. Competencies inform, or contain, learning outcomes, and curriculum and assessment are designed in accordance with them. Curriculum is often modular, with modules based on individual competencies or clusters of competencies (Harris et al. 1995). Assessment is either wholly or substantially performance based, with criterial performances drawn from the specifications recorded in competence articulations (Tovey and Lawlor 2004). Educators in competence-based education programmes are ostensibly valued primarily for their occupational and pedagogical expertise, although technical expertise in the use of competence-based systems is highly prized (Innovation and Business Skills Australia 2013).

6.6 Understanding Competence-based Education Critique

When examining an argument about the value, whether positive or negative, of competence-based education, we can profitably ask what epistemological assumptions are being invoked. By raising that question, we may determine the extent to which an argument is consistent with an epistemology or whether it attempts to combine epistemologies. The rationale for the epistemological framework suggests that arguments spanning more than one epistemology risk incoherence, since the epistemologies make incompatible claims. It also, thereby, suggests that coherent arguments from different epistemologies may, in combination, be intractable.

For critique from a disciplinary epistemological perspective, the ends of competence-based vocational and professional education distort, diminish or neglect the theoretical, knowledge-dependent or disciplinary dimensions of occupations. Addressing the emergence of competence-based teacher education programmes, Broudy (1972) argued that theory is essential to understanding the principles of disciplinary knowledge, acknowledging that not all professionals could supply a theoretical account of their practice, but that this phenomenon may be misunderstood as justifying the removal of theoretical curriculum from teacher preparation programmes. Competence-based approaches were argued by Broudy and also Carr (1993), as being unable to engage with or accommodate theoretical knowledge, because practical, contextualised applications become the *content* of competence-based programmes and learning assessments *of* those contextualised performances. Wheelahan (2007) extended this criticism, arguing that workers in any skilled occupation require access to the 'generative principles' of disciplinary knowledge, if they are to be equipped to respond skilfully to new situations and to engage with the broader discourse surrounding their occupational fields. Gamble (2003) made a similar point in her analysis of knowledge structures in crafts, arguing that the knowledge employed in crafts is not simply the application of disciplinary knowledge to practical problems, because it has distinctive conceptual forms and relationships to its context.

Critique from a constructivist epistemological perspective takes issue with the way the approach sidelines questions of growth, development, responsibility and awareness. Mezirow (1978) attacked competence-based education and allied approaches to learning for their narrow focus on technical proficiency. He suggested that such educational practices 'address the wrong reality' (1978: 107), if the goal of learner development is a creative and self-fulfilled worker. Research by Hodge (2010, 2011, 2014), employing Mezirow's theory of transformative learning to understand deep learning in the context of competence-based vocational education, found that transformative learning did occur in such settings, but that it did so *despite* the competence-based curriculum, rather than *because* of it. Occupational specialists and educators interviewed for that research affirmed that personal development was essential to competent practice in the occupations studied, but that the competence-based curriculum and pedagogies were indifferent to it. The research participants valued curriculum and pedagogies that confronted learners with mor-

ally challenging work-based dilemmas and educators who were capable of understanding the dynamics of deep, painful change in learners. Collins (1987) used a 'theory of relevance' to critique competence-based education. He argued that, because competence-based education presents educators and learners with 'prepackaged' curricula, learners are positioned as passive receivers, rather than as active seekers, of knowledge, requiring them to 'dissociate' themselves from their own direct experience to accept outcomes specified in competence statements.

Criticism of competence-based education from an emancipatory epistemological perspective finds it to be a form of control by powerful interests. Moore (1987) argued that the competence-based approach encoded a conservative form of control over the education system, eroding the autonomy of vocational educators and students through restricting their access to the knowledge contexts that justify action. He argued that the competence-based 'new vocationalism' was an 'ideology of production', used to regulate education. For Field (1991: 42), the competence approach constituted a 'pedagogy of labour', through which a 'new Fordism' is introduced, undermining worker autonomy, devaluing work and denying vocational education any role in being 'future oriented and even emancipatory'. Jackson (1993: 155) called competence-based approaches to vocational education an 'ideological practice' that not only reasserts control by employers over workers but also serves to extend this control to the institutions and practices of vocational education. Edwards and Usher (1994), using Foucault's concept of disciplinary power, showed that the atomisation of skill and knowledge through competence statements and the assessment and reporting practices of large-scale systems of competence-based vocational education facilitated the surveillance of individuals and the compliance of learners with the dictates of the system: creating a potent mechanism for the production of 'docile bodies' incapable of critical action. Hodge and Harris (2012) went further in arguing that competence-based vocational education serves to discipline employers and educators as well as learners in the promotion of orderly conduct at the level of the population. Jones and Moore (1993) argued that competence-based professional education may best be understood as a broad agenda of state control over professional expertise, in which the conversion of bodies of knowledge into the visible codes of competence statements facilitates the transfer of control from these groups to bureaucrats.

6.7 Understanding the Contemporary Ascendancy of Competence-based Education

The framework of educational epistemologies gives us a way to comprehend the contemporary appeal of competence-based vocational and professional education. We maintain that this appeal is due in large part to the dominance of instrumental epistemology in the broader cultural context characterised by what we term 'globalising performativity'. Globalisation is here understood as the process of

international integration and convergence of culture and cultural artefacts, including political, social and economic systems (Giddens 1990). Contemporary globalisation is characterised by the prevailing cultural context of performativity (Lyotard 1984/1979). It is driven to the point of it being the contemporarily dominant cultural determinant internationally by the cultural pervasion of information technology (Castells 1998). That cultural context is grounded in the logically inevitable progression of the Enlightenment project of critical rational empiricism to the point where it undermines the grounds for the traditional commitment to the universal intrinsic values of progressive humanism (Bagnall 1999). It thus engenders a culture substantially lacking in nonarbitrary intrinsic value, in which human activity is strongly focused on instrumentally achieving outcomes drawn from a multiplicity of different domains of human engagement and systems of belief and in which the only constant common determining value is that of achieving competitive advantage: a culture of performativity (Dreyfus and Kelly 2011).

Such a cultural context has a number of dimensions, but those that are of particular importance to the analysis in this chapter are as follows (Henry et al. 2001; Marginson and van der Wende 2007; Rizvi and Lingard 2010):

1. Performativity focuses on, or places a high value on, *action*: on doing, on performing and on achieving.
2. In so doing, it focuses on *outcomes* – on what is done or achieved in and through that action and on its *effectiveness* in doing so.
3. Such performativity is both grounded in and exhibits the *externalisation* of value from human engagements. Value is *extrinsic* to, rather than intrinsic in, those engagements.
4. In its focus on achieving desired performance outcomes of extrinsic value, performativity places a high value on the *efficiency* with which resources are used in doing so, to the exclusion of other outcomes being achieved.
5. Such performativity therein promotes attention to the *comparative competitive advantage* of different types of engagements, processes, programmes, policies or organisational arrangements in achieving the desired outcomes.
6. In assessing comparative competitive advantage, all value tends to be reduced to a common criterion or currency: that of *economic* cost and benefit, cultural 'economism'.
7. The focus, then, is on *technical*, *mechanistic* or *programmatic* relationships between the desired economic outcomes and the costs of contributing human actions, engagements, policies and interventions.

These dimensions of the prevailing cultural context of performativity clearly align strongly with the features of instrumental epistemology and instrumental education, outlined above. Conversely, they are, to varying degrees, incongruent with the other three epistemologies and their educational implications, from which the greater bulk of arguments against competence-based vocational and professional education – as a type of instrumental education – are drawn. In such a context, arguments against competence-based education may be expected to carry less weight than those for it.

Although other sectors of education are affected by this context, vocational and professional education are particularly so, because of the tendency to see them as being essentially concerned with enhancing *economic* advantage through skill development (Moore 1987). Performativity thus impacts globally on vocational and professional education policy reform through the perceived imperative for that sector of education to contribute efficiently and effectively to enhancing comparative competitive advantage at all social and political levels: from that of the individual seeking work in competition with others to that of a national economy being governed to compete successfully against others in producing goods and services.

The power of the contemporary globalising context of performativity may also be seen as being heightened by the arguably significant degree of *incommensurability* between and among the four epistemologies and their respective approaches to education. The notion of incommensurability here is that of the differences between the epistemologies and their approaches to education being irresolvable unless essential features of education informed by the respective epistemologies are denied (Feyerabend 1978). The incommensurability here flows partly from the irrationality of compromise, because the differences are not just a matter of degree, but also of kind: they speak to different features of education. It also flows from the unethical nature of compromise: since the identified characteristics of education flowing from each epistemology are matters of *ethical* concern, denying the implications of an epistemology is strictly unethical. The incommensurability is, though, most importantly grounded in the *totalising* nature of each epistemology, in that the educational implications of each epistemology constitute, normatively, the valued nature of *all* education or all education in a certain domain. None of the epistemologies has the nature of a partial construct, the educational implications of which may be taken on board to some variable extent and which therefore might be combined with selected features flowing from other epistemologies.

The comparative characteristics of the four epistemologies articulate this incommensurability. We take here, as an example, just the criterion of the focus of the educational engagement. For disciplinary education it is a view of education as the immersion of learners in the theoretical content of academic disciplines. For constructivist education, it is a view of education as the immersion of learners in authentic experiences. For emancipatory education, it is the immersion of learners in social criticism and action. And for instrumental (including competence-based) education, it is the engagement of learners in predetermined routines. We suggest that it is straightforwardly self-evident that each of those properties is substantially incommensurable with the others. It is not possible, for example, to develop education that is both characterised as being the immersion of learners in the theoretical content of academic disciplines and as being their immersion in authentic experiences. Each speaks to a different form of education, any compromise of which is a matter of ethical concern from its epistemological perspective, and each demands recognition as an *essential* feature of education.

In the light of that incommensurability, the arguments from different epistemological perspectives may be seen as creating a policy environment of forced choice between the epistemologies. In such a situation, political action and educational

policy will tend to be shaped by influences outside the logic of the epistemologically based educational arguments. The strength of the press from the globalising cultural context of performativity may be expected, then, to dominate at the political and hence the policymaking levels. In such a context, there is little likelihood that educational arguments from disciplinary, constructivist or emancipatory epistemological perspectives will have any significant political or policymaking purchase, but every likelihood that educational arguments from an instrumental perspective will do so.

6.8 Implications for Competence-based Approaches to Vocational and Professional Education

What, then, of vocational and professional education? Where does this take our collective identification with competence-based education as the only practicable approach to vocational and professional education? In the face of political and policy pressures from the contemporarily pervasive globalising cultural context of performativity, the arguably high degree of incommensurability between the different epistemologies and their respective approaches to education may be expected to favour the continuing advance and domination of competence-based approaches to education.

However, it should also be appreciated that different epistemologies and their respective educational approaches may be seen in this respect as alternative *paradigms*, commitment to which may change over time, not only in response to changing contexts but also in response to the cumulative weight of argument (Kuhn 1970). Accordingly, continuing critique of competence-based education, especially critique that is informed by an understanding of the epistemologies involved, may, over time, lead to a body of evidenced argument that may, in itself, reach a tipping point, from which political allegiance may veer in positive response to an alternative that it is suggesting: that is, a paradigm shift towards education informed by one of the alternative epistemologies. In the longer term, the situation may thus be expected to change, unless history fails to serve as an indicator of the future.

When that happens (if, indeed, it does so), we may expect consideration to be given to the major competing alternative epistemologies here outlined. What, then, of the future prospects of those alternatives? Firstly, it should be noted that our argument for the significant incommensurability of the competing epistemologies points to the probable failure of attempts to hybridise competence-based education with selected elements of educational approaches informed by its competing epistemologies. Although an important strand of theory, policy and practice has been focused on such a task (Hager and Gonczi 1991; Mansfield and Mitchell 1996), our argument points to the probable futility of such moves. Any question, then, of what competence-based vocational and professional education might look like if it were to take into account critique from the other epistemologies is unanswerable, because the limitations of competence-based education from the perspectives of the other

epistemologies are such as to challenge its essential nature and assumptions. The important point here is that the epistemic foundation of each cluster of competing approaches to education is fundamentally distinctive and exclusive. It not only articulates a distinctive conception of the nature of valued knowledge, but, in doing so, it *excludes* other constructions of valued knowledge.

What, then, remains? Must we choose – assuming that we have any choice in the matter – between approaches grounded in disciplinary, or constructivist, or emancipatory epistemologies? Responding to that question, we might note, firstly, the improbability of a general shift back to vocational and professional education evidencing any of the other three (noninstrumental) epistemologies. While disciplinary, constructivist and emancipatory epistemologies may be expected to provide firm foundations for generating telling arguments against instrumentalist educational approaches, their general incompatibility with the contemporary cultural context does not suggest any widespread move back to any of them.

We might also though, and secondly, note that there are suggestions of a shift in the contemporary cultural context, which is making it less compatible with instrumental epistemology. Theorists of contemporary globalisation have argued in different ways that globalisation is importantly characterised by a dynamic tension between forces for globalising homogenisation (cultural convergence) and those for localising heterogenisation (cultural pluralisation) (Powell and Steel 2011). In recent decades, the forces for homogenisation have been seen to prevail over those of heterogenisation (Halliday 2012), which has favoured the highly systematic epistemology of instrumentalism. There may, though, be seen as occurring now a shift to more localised forms of globalisation, foregrounding diversity, flexibility and situational responsiveness, with which educational approaches evidencing instrumental epistemology would not be congruent (Castells 1996). Contemporary information technology may also be seen as moving in the same direction: away from massified approaches to communication towards more tailored, localised approaches, often within globalised frameworks (Castells 1998). More broadly, knowledge, value and action are also becoming more contextualised (Bagnall 1999), in a direction that is increasingly at odds with instrumental epistemology. It is arguable that the privatisation of risk, performance and responsibility to progressively lower levels of social organisation (and ultimately to individuals) – which is an important feature of contemporary globalisation – is also becoming more pronounced and hence contra-indicative of instrumental epistemology (Edwards 2012). In essence, the globalised *pluralisation* of social meaning is undermining the ascendancy of globalised homogenisation (Edwards 1997).

Such shifts, though, may be expected to have little impact on the overall incompatibility of disciplinary, constructivist and emancipatory epistemologies with the prevailing cultural context. On the other hand, they do admit the possibility of en emergent new educational epistemology – one we term *situational* – arising out of the old prevailing (instrumental) epistemology and hence taking on and reworking key features of that originating epistemology. The emergence of such a situational epistemology has been largely overlooked in contemporary educational theorisation, because it has been marginalised under the banner of sociological *postmodernity*

(Bagnall 1999; Briton 1996). The form of such an epistemology remains as yet unclear, beyond the speculative theorising in works such as those cited above. It calls, though, for further critical analysis to tease out its emerging characteristics.

6.9 Conclusions

In conclusion, we suggest that the analytical perspective presented here, at the very least, makes a case for the importance of underlying epistemologies to understanding, interpreting and responding to the ongoing criticism of the educational value of competence-based vocational and professional education. There may be further argument about the nature and boundaries of the epistemologies that are important in framing such criticism, and there may be further argument about the nature and boundaries of the educational approaches that each informs, but our analysis may be understood, at the very least, as demonstrating the importance of epistemologies *to* the debate.

Using that epistemological framework, the analysis outlined here points to the probable futility of attempts to develop hybrid versions of competence-based vocational and professional education in response to criticism of competence-based education from noninstrumental epistemological perspectives. It suggests that, in our continuing commitment to competence-based approaches to vocational and professional education, we should accept them, unalloyed, as the best that we can do in the circumstances. It suggests also, though, that continuing shifts in the prevailing cultural context and the weight of argument against instrumentalist approaches may, in due course, reach a tipping point, at which the cumulative weight of that argument would lead to the rejection of competence-based education and its instrumental epistemology and to the adoption of educational approaches evidencing an alternative epistemology. Intimations of a shift in the prevailing cultural context point to the possible generation of a new, *situational*, epistemology to take over the mantle of hegemony from the instrumental.

That conclusion points to the value of undertaking further theorisation and articulation of the changing cultural context and of the nature and possibility of a situational epistemology in response to the changes. Continuing critical attention to the nature and impact of competence-based approaches to vocational and professional education might also valuably be undertaken more systematically through the epistemological framework here presented.

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Chapter 7
Mindful Working and Skilful Means: Enhancing the Affective Elements of Vocational Education and Training Through the Ethical Foundations of Mindfulness

Terry Hyland

7.1 Introduction

Mindfulness-based interventions (MBIs) which make use of the direct awareness and present-moment attention adapted from Buddhist mindfulness practices are now influential in a wide range of fields and disciplines including psychology, psychotherapy, mind-body health professions and education and training at all levels. Although MBIs – by nature developmental, contemplative, process oriented and radically experiential – do not fit easily into formal educational contexts (Hyland 2011), their use in programmes of professional and vocational development has led to adaptations which involve standardisation of inputs and the quantitative measurement of outcomes. It will be suggested that instances of such standardisation – described as 'McMindfulness' by critical commentators (Purser and Loy 2013) – may be counterproductive and serve to emasculate mindfulness practices. After examining the nature and current state of development of MBIs, I go on to question whether these standardising trends – particularly when allied with competence-based education and training (CBET) approaches concerned with prescriptive outcomes – can be reconciled with the foundational values and principles of mindfulness. Finally, some suggestions are made with the aim of ensuring the moral and affective integrity of MBIs connected with the personal development and vocational education and training (VET) of students, trainees and employees.

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7.2 Mindfulness: Origins and Growth

Mindfulness has become something of a boom industry over the last few decades thanks largely to the work of Kabat-Zinn (1990) who developed a mindfulness-based stress reduction (MBSR) programme in his work at the University of Massachusetts Medical School in 1979. Since then, the work of Kabat-Zinn and associates (Kabat-Zinn 2005; Segal et al. 2002; Williams, et al. 2007; Williams and Kabat-Zinn 2013) has been responsible for a massive global expansion of interest in mindfulness-based interventions in a diverse range of domains including work in schools, prisons, workplaces and hospitals, in addition to wide applications in psychology, psychotherapy, education and medicine. An Internet search on the concept of mindfulness brings up around 18 million items, and, in terms of publications, numbers have grown from one or two per year in 1980 to around 400 per year in 2011 (Williams and Kabat-Zinn 2013, p. 3; the growth of mindfulness research papers has been exponential in recent years, see *American Mindfulness Research Association*, https://goamra.org/).

Thich Nhat Hanh (1999) – the renowned Vietnamese Buddhist teacher and campaigner for world peace and justice – describes mindfulness as being 'at the heart of the Buddha's teachings'. It involves 'attention to the present moment' which is 'inclusive and loving 'and 'which accepts everything without judging or reacting' (p. 64). Kabat-Zinn (1990, 1994) and associates have been largely responsible for transforming the original spiritual notion into a powerful and ubiquitous therapeutic tool based on forms of meditation and mindful practices. Mindfulness simply means 'paying attention in a particular way, on purpose, in the present moment and non-judgementally' in a way which 'nurtures greater awareness, clarity and acceptance of present-moment reality'. Such practice – whether this involves breathing or walking meditation or giving full non-judgemental attention to everyday activities – can offer a 'powerful route for getting ourselves unstuck, back in touch with our own wisdom and vitality' (Kabat-Zinn 1994, pp. 4–5).

Since all educational activity involves some level of judgement, this non-judgemental aspect of mindfulness practice needs to be explained. If we are driving a car, mindfully we are, of course, making all kinds of essential first-order judgements concerned with speed, distance, other motorists and pedestrians. What mindfulness attempts to achieve is the fostering of this present-moment activity without adding second-order judgements concerned with worries about yesterday, plans for tomorrow or other extraneous notions. It involves switching off the autopilot, the default mode of the mind which is often preoccupied with regrets, anxieties or pointless rumination. Mindful driving is, thus, just driving in the here and now. Such non-judgemental awareness has been demonstrated to enhance clarity, focus and, ultimately, general mind/body well-being. Gunatarana's conception of mindfulness as 'mirror thought' (2011) expresses this non-judgemental aspect very well. As he comments:

> Mindfulness…just perceives… It takes place in the here and now. It is the observance of what is happening right now, in the present. It stays forever in the present, perpetually on the crest of the ongoing wave of passing time. (pp. 133–4)

Thus, when we are mindfully driving, teaching, solving a problem in physics, repairing an electrical fault or writing about educational theory, we are engaged in just *these* activities at a first-order level. We are not also involved in second-order judgements involving the appraisal of our second-order feelings, thoughts about the past/future or other extraneous rumination about these activities.

7.3 Mindfulness, Education and Psychology

The various mindfulness-based interventions (MBIs) – in psychotherapy, mind-body health and education – referred to above represent connections between Eastern spiritual traditions and Western science. Psychology, psychotherapy and related fields are the ones which tend to predominate in terms of this process of mutual interrelationship. A number of psychologists and psychotherapists (Epstein 2005) have regarded Buddhism as a form of study of the nature of the mind. Germer (2005) asserts simply that 'reading early Buddhist texts will convince the clinician that the Buddha was essentially a psychologist' (p. 13).

The neuroscientific evidence about the impact of MBIs on the functioning of the brain – and the resultant possibility of changing cognitive, affective and psychomotor activity – are directly relevant to education in general and VET in particular. A good place to start is with the relationship between the mind and brain. Siegel (2007) explains that the brain 'is an integrated part of the whole body'. He goes on to elaborate this statement:

> Because the mind itself can be viewed as both embodied and relational, our brains actually can be considered the social organ of the body. Our minds connect with one another via neural circuitry in our bodies that is hard-wired to take in others' signals. (p. 48)

What needs to be added to this is that 'attention to the present moment, one aspect of mindfulness, can be directly shaped by our ongoing communication with others, and from the activities in our own brains' (ibid., p. 50). Recent neuroscientific work indicates that, on the one hand, neural networks in the brain can be altered by experience and, on the other, that mindfulness practice can help to bring about such change. As Doidge (2007) observes, the 'idea that the brain can change its own structure and function through thought and activity is…the most important alteration in our view of the brain since we first sketched out its basic anatomy and the workings of its basic component, the neuron' (pp, xv–xvi). He goes on to describe a wide range of cases – from physical ailments to emotional disorders – in which brain changes have been demonstrated to be connected with either cures or improvements in health.

Siegel (2007) has suggested that 'at the heart of mindfulness is the teachable capacity for reflection' and that this 'learnable skill is just a breath away from being

readily available as the fourth "R" of basic education' (pp. 259–260). Siegel's work has shown that 'resilience can be learned through experience' (p. 215), and he picks out the key features of mindfulness strategies – approaching rather than avoiding difficult states, replacing rumination with observation based on curiosity and kindness and the reflection on thoughts and feelings using notation and labelling (ibid., pp. 216–225) – as ways of establishing calm and stability by integrating left and right hemispheres of the brain.

If we then connect this notion of changing the mind/brain through learning (unlearning and relearning) through experience, we can begin to see the powerful educative aspects of mindfulness-based approaches. Through the standard practices outlined in the literature – attending to the breath, mindful walking or movement or, indeed, any technique which helps us to still the restless and wandering mind and 'learn to pay attention to the *experience of paying attention* (Schoeberlein and Sheth 2009, p. xii, original italics) – it is possible to reduce unhelpful rumination and experiential avoidance in our mental lives and, when appropriate, to switch off the automatic pilot for longer and longer periods. The ethical and attitudinal bases of the practice also indicate that mindfulness 'is not just about paying *more* attention, but rather about cultivating a *different*, wiser kind of attention' (Williams et al. 2007, p. 99, original italics). Experiments using MRI and EEG brain scanning have demonstrated clear and direct connections between meditation and changes in the brain, particularly in relation to brain states and different types of emotion (Goleman 2003). The capacity to generate compassion, lovingkindness and 'introspective skill' (ibid., pp. 11–23) in training the mind through meditation has been observed in laboratory experiments with meditators. More specifically, Davidson et al. (2003) found 'a shift in the baseline of long-term meditators toward left anterior activation' of the brain, and this left shift was also linked with enhancement of immune functions of people who had completed mindfulness courses. fMRI scans of the brain's prefrontal cortex have connected negative emotions with the right area and positive feelings with the left (Goleman 2003, p. 340).

Research on the introduction of mindfulness in schools and colleges tends to confirm these observations. The 'present-moment reality' developed through mindfulness is widely acknowledged in educational psychology as not just 'more effective, but also more enjoyable' (Langer 2003, p. 43) in many spheres of learning, and there is now a wealth of evidence aggregated through the *Mindfulness in Education Network* (http:/ /www mindfuled.org) about the general educational benefits of the approach. On the basis of work done in American schools, Schoeberlein and Sheth (2009) list a wide range of benefits of mindfulness for both teachers – improving focus and awareness, increasing responsiveness to student needs and enhancing classroom climate – and students in supporting readiness to learn, strengthening attention and concentration, reducing anxiety and enhancing social and emotional learning. As they put it:

> Mindfulness and education are beautifully interwoven. Mindfulness is about being present with and to your inner experience as well as your outer environment, including other people. When teachers are fully present, they teach better. When students are fully present, the quality of their learning is better. (p. xi)

The use of mindfulness in British schools is showing similarly promising results. Burnett (2011) has shown its value when incorporated into moral/religious education or personal and social health programmes (PSHE), and the controlled trial conduct by Huppert and Johnson (2010) with 173 secondary school pupils indicated a positive impact of mindfulness-based approaches on emotional stability and an increase of well-being. The therapeutic applications of mindfulness strategies were recommended in the report sponsored by the Department for Business Innovation and Skills, *Mental Capital and Wellbeing* (Government Office for Science 2008), and there are a number of well-established centres for the research and teaching in mindfulness-based approaches: the Centre for Mindfulness Research and Practice at the University of Wales, Bangor (www.bangor.ac.uk/mindfulness), the Oxford Cognitive Therapy Centre (www.octc.co.uk), and the University of Exeter (www.exeter.ac.uk).

In addition to the studies noted above, a body of educational research evidence is beginning to emerge from the UK *Mindfulness in Schools Project* (MiSP; Burnett 2011). A project undertaken in secondary schools connected with the MiSP (officially called the .b project) by Hennelly (2011) involving 64 mixed-gender pupils reported that mindfulness training brought about immediate improvements in adolescents' functioning and well-being and (on the basis of a questionnaire survey conducted 6 months after experience on the .b programme) established that these positive effects were maintained. More recently, a large-scale experimental project conducted by Kuyken et al. (2013) investigated the impact of mindfulness training in a study involving a total of 522 young people aged 12–16 in 12 secondary schools connected with the MiSP initiative. The results indicated that the pupils

> who participated in the intervention reported fewer depressive symptoms post-treatment and at follow-up and lower stress and greater well-being at follow-up. The degree to which students in the intervention group practised the mindfulness skills was associated with better well-being and less stress at 3-month follow-up. (p. 1)

7.4 Vocational Education and Training and the Mindful Workplace

Chaskalson (2011) has investigated the increasing use of MBIs in workplace settings, and a number of corporations are now showing an interest in introducing mindfulness training for their employees (see Aetna.com 2014). Although Chaskalson initially appears to be examining the applications of mindfulness to training and work in general, the analysis is restricted mainly to the links between the efficacy of MBIs in promoting emotional intelligence (EI) at the level of management and leadership. Much is made of Goleman's work in this sphere, particularly its applications in the workplace. In the light of his theories of emotional intelligence (Goleman 1996), Goleman (2001) had originally analysed data from competence models used in leading companies such as IBM, British Airways and

Credit Suisse, as well as public-sector organisations in the attempt to discover those personal capabilities that underpinned optimal performance at all levels.

Chaskalson (2011) cites a broad range of studies which indicate the importance of EI in teamwork, creative thinking, leadership and innovation in different work environments before explaining how MBSR programmes may contribute to the development of EI through the cultivation of insight, focus, concentration and empathy. In a concluding section (ibid., pp. 164–5), he sums up the research findings about the typical impact of the 8-week MBSR course on participants. These included a reduction in participants' levels of stress, an increase in their emotional intelligence, increased attention span and lower rates of absenteeism. Some of the problems and pitfalls of measurement in this field – particularly when tailor-made psychological tests based on self-reporting are used – will be discussed in more detail below. At this stage, it is worth pointing a number of related problems involved in applying standardised mindfulness courses such as MBSR/MBCT in workplace settings.

Chaskalson (pp. 168–170) fully recognises the logistical problems of organising and delivering MBSR courses in the workplace. They are costly in time and effort to both employers and employees and – unless adapted to specific work environments – may seem remote from everyday working practices. More significantly – as may be discerned by the potential benefits listed above – they tend to be used primarily to develop skills and traits linked to productive workplace outcomes whether or not these are representative of foundational mindfulness principles. The appropriation of MBIs by corporations such as Google has been labelled the 'gentrification of the dharma' by Eaton (2014), who reports that 'many Buddhists now fear their religion is turning into a designer drug for the elite' (p. 1). In a similar critical vein, Stone (2014) has observed that:

> Mindfulness meditation has exploded into an industry that ranges from the monastery to the military. Google, General Mills, Procter & Gamble, Monsanto and the U.S. Army are just a handful of the many enormous institutions that bring meditative practice to their workforce. (p. 1)

He goes on to point out the dangers – and in the case of the US Army, the monstrous absurdity – of allowing Buddhist principles of non-violence and lovingkindness to be appropriated by organisations concerned with ends which are diametrically opposed to the principles upon which mindfulness is founded.

It is true that the affective aspects of learning have tended to be seriously neglected at all levels, and there are direct connections between educating the emotions and cultivating mindfulness (Hyland 2010, 2014b). If the use of mindfulness is able to reduce stress and enhance mind/body well-being in anyone – whether they are employees, soldiers or monks – through the mindful control of destructive emotions, then, of course, such strategies are worthy of our provisional approval. However, if emotional literacy, greater attention focus and economic productivity rather than mindfulness rooted in fundamental ethical principles become the primary goals – as seems to be the case in Chaskalson's account and the corporate programmes noted above – then the rationale for and viability of full 8-week MBSR

courses for either employers or trainees become questionable. For this reason, workplace training in this sphere generally takes the form of short subject- or trait-specific courses (typically over 1 or 2 days) aimed at enhancing leadership, management or teamwork qualities (Aetna.com 2014; Eaton 2014). Moreover, the outcomes sought are almost always designed with any eye to increasing productivity as the question becomes, 'Can mindfulness increase profits?' (http://mindfulnet.org/, 2014).

All this is perhaps both predictable and in the nature of the economics of VET and trainee development, though it does raise the question of what any of this has to do with the concept of mindfulness outlined earlier in this chapter. Where are the references to the longitudinal cultivation of values and traits in keeping with the compassionate and equanimous elements of mindfulness? Such developments represent to a paradigm case of the decontextualising and denaturing of the original formulation of the Kabat-Zinn vision which has been correctly labelled 'McMindfulness'. It is also a classic example of the commodification of the educational enterprise which has rightly been labelled the 'McDonaldisation' of learning and teaching over the last few decades (Hartley 1995; Hyland 1999). There are clear connections here between this mutation of mindfulness and the outcome-based assessment strategies associated with CBET, and these are worth examining in more detail.

7.5 Competence, McMindfulness and the Assessment of Outcomes

As indicated above, MBIs are increasingly influential in a growing range of fields including education and training at all levels. However, there are tensions between the ethical and attitudinal foundations of mindfulness and the bureaucratic and assessment demands of educational systems and corporate structures. Practitioners seeking to resolve some of these tensions and potential difficulties have adopted a number of strategies which involve the modification and adaptation of mindfulness conceptions and principles. The main techniques in this restructuring of MBIs are standardisation of inputs and the quantitative assessment of outputs, and I intend to discuss each of these developments in turn.

7.5.1 McMindfulness and the Standardisation of the Present Moment

The exponential progress of mindfulness perspectives in academic disciplines has been driven in the main by the use of MBIs in psychology and psychotherapy. The original mindfulness-based stress reduction (MBSR) developed by Kabat-Zinn

(1990) at the University of Massachusetts Medical Center in 1979 has itself been standardised as an 8-week part-time programme which is now delivered worldwide in a diverse range of settings (Hyland 2011). This programme has subsequently been modified – specifically aimed at people with low mood disorder or mild depression – and linked with cognitive behavioural principles (Williams, et al. 2007) to produce an 8-week mindfulness-based cognitive therapy (MBCT) course which, as indicated in earlier sections, is increasingly influential in counselling, psychotherapy and many other related personal development and training contexts.

Although the foundational ethical and affective principles of the MBSR/MBCT programmes are, theoretically, meant to be unchanged in all the different contexts in which they are now applied, it is inevitable that the removal from their natural home and constant iteration/reinterpretation have resulted in changes and modifications, not all of which are in keeping with the original blueprint (Kabat-Zinn 2013). The sheer volume of contemporary applications of MBIs is staggering and, by itself, is responsible for the adulteration of the original aims.

This populist appeal of mindfulness notions are noted by Purser and Loy (2013) in their critical evaluation of what they call 'McMindfulness' programmes. As they express the key issues:

> The mindfulness revolution appears to offer a universal panacea for resolving almost every area of daily concern… Almost daily, the media cite scientific studies that report the numerous health benefits of mindfulness meditation and how such a simple practice can effect neurological changes in the brain. (p. 1)

The upshot of all this, inevitably, is a marginalisation of the original foundational principles and a distortion of the ultimate aims and procedures. As Purser and Loy conclude:

> While a stripped-down, secularized technique–what some critics are now calling "McMindfulness"–may make it more palatable to the corporate world, decontextualizing mindfulness from its original liberative and transformative purpose, as well as its foundation in social ethics, amounts to a Faustian bargain. Rather than applying mindfulness as a means to awaken individuals and organizations from the unwholesome roots of greed, ill will and delusion, it is usually being refashioned into a banal, therapeutic, self-help technique that can actually reinforce those roots. (ibid)

On another level, the wholesale expropriation of MBIs by academic psychologists and mind-body health professionals – reflected in the ever-burgeoning academic publications noted earlier – has exacerbated the 'decontextualisation' referred to by Purser and Loy by transmuting mindfulness practice into just another academic field of study. The overwhelming majority of such academic publications involve the quantitative measurement of mindfulness (Baer 2013) – the mutation of present-moment 'being' into outcome-oriented 'doing'. Such developments have led to a proliferation of mindfulness measurement scales (see *Mindfulness Research Guide*, 2014; http://www.mindfulexperience.org/measurement), most of them claiming quantitative outcomes based on qualitative self-reporting.

All of these scales are connected with the various benefits of MBIs in the areas of depression, addiction and mind-body well-being, and it is such evidence-based

positive results of the strategies which, according to Baer (2013), both justify such measurement and explain their consistent influence. As she concludes:

> Adaptations from the original Buddhist teachings may be necessary, and intended and unrecognised conceptual slippage may be hard to avoid. (p. 258)

All these developments – and the 'conceptual slippage' referred to by Baer – mean that contemporary MBIs are quite some way from both the Buddhist home of mindfulness and also the original secular therapeutic aims. Kabat-Zinn's evaluation of all these developments is, naturally, both interesting and informative. Since his original work on the MBSR programme has spawned the current mindfulness revolution, Kabat-Zinn's criticisms of contemporary developments are understandably nuanced. Acknowledging the 'challenging circumstances relating to the major cultural and epistemological shifts' as Buddhist meditation was introduced into clinical and psychological settings, Williams and Kabat-Zinn (2013) observe that:

> Buddhist scholars, in particular, may feel that the essential meaning of mindfulness may have been exploited, or distorted, or abstracted from its essential ecological niche in ways that may threaten its deep meaning, its integrity, and its potential value. (p. 11)

The answer to such challenges is the 'building of bridges with an open mind' (ibid., p. 12) between all Western and Buddhist perspectives. More fundamentally, all those concerned with mindfulness practice – teachers, trainers, practitioners and academic researchers – should be aware at all times of the 'ethical foundation of MBSR' (Kabat-Zinn 2013, p. 294) and its roots in the universal *dharma* of loving-kindness, compassion and the relief of suffering in ourselves and others.

Since the exponential development of the mindfulness industry, Grossman (2011) has been forceful in his criticisms of mindfulness measurement scales, particularly those relying upon self-reports by MBI course participants. The key weaknesses are that they decontextualise mindfulness from its ethical and attitudinal foundations; measure only specific aspects of mindfulness such as the capacity to stay in the present moment, attention span or transitory emotional state; and, in general terms, present a false and adulterated perspective on what mindfulness really is. Such developments are of precious little benefit to any of the interested parties whether they are, learners, teachers, mindfulness practitioners or external agencies interested in the potential benefits of MBIs.

More recently, Grossman and Van Dam (2011) have summarised some of the limitations of this overly quantitative approach to mindfulness. As they observe:

> Unlike testing mathematical skills, there is no litmus test for mindfulness, no telltale growth or activity in the brain, nor are there any behavioural referents that have been documented as specific to mindfulness. This situation opens the door for definitions of mindfulness that are in danger of losing any relationship to the practices and teachings that gave rise to MBSR and MBCT. (p. 232)

The proliferation of mindfulness scales which has accompanied the exponential growth of programmes has exacerbated this denaturing of the original conception, and it is now no longer clear precisely what is being measured. Such developments are counterproductive and unhelpful to all those working in the field since they tend

to ‘misconstrue and banalize the construct of mindfulness’ (p. 234). Along with the gradualness of mindfulness development, this ‘way of being’ is not susceptible to summative psychological testing. Instead, Grossman and Van Dam recommend formative assessment techniques employing longitudinal interviews and observations of MBI participants in specific contexts. More significantly – especially in the light of what I argue below about mindfulness and competence – the critics make the eminently sensible suggestion that ‘one viable option for preserving the integrity and richness of the Buddhist understanding of mindfulness might be to call those various qualities now purporting to be mindfulness by names much closer to what they actually represent’ (ibid., p. 234). Thus, such scales may legitimately be said to measure attention span or ability to still the mind for a given period; this is not the same at all as measuring mindfulness. I make very similar points below about CBET systems which attempt to make the concept of competence bear far more weight than it can possibly carry.

7.5.2 Competence and the Quantitative Measurement of Mindfulness

The standardisation of mindfulness approaches linked to the quantitative measurement of outcomes has precise parallels with the way CBET was applied to all aspects of learning and curriculum from the 1980s onwards and is, thus, subject to similar weaknesses and criticisms. In later sections of this volume, commentators will be drawing attention to the application of competence approaches to various levels of learning. The criticisms of this process set out below are, therefore, intended to be taken as a cautionary note, a framework of sceptical ideas which may assist us in steering clear of the more obvious traps and pitfalls.

The story of how CBET was introduced into VET in England through the establishment of the National Council for Vocational Qualifications (NCVQ) in 1986 has been told by many commentators in the field (Bees & Swords1990; Bates 1998) including myself. Following a number of critical reviews and reports about the work of the NCVQ throughout the 1990s (Beaumont 1996), the NCVQ was abolished in 1997 (general NVQs were phased out completely by 2008, and NVQs now play a much reduced role in the English system) and subsumed under the overarching Qualifications and Curriculum Authority (QCA). In my own critique, I argued that NVQs – and indeed all programmes and qualifications supported by CBET functional analysis – were ‘logically and conceptually confused, epistemologically ambiguous, and based on largely discredited behaviourist learning principles’ (Hyland 1994, p. x). This conclusion was supported by philosophical argument, policy analysis and empirical research (Hyland 1997, 1998, 2006, 2008). Given the wealth of critical analysis surrounding CBET offered elsewhere and in other sections of this volume, I do not intend to rehearse all of the old arguments here. Instead, I will offer some specific critical comments intended to supplement the

earlier arguments as a preliminary to the primary task of explaining what I take to be the serious tensions and conflicts between the learning project associated with MBIs and the outcome-based behaviourism inherent in CBET systems.

The fact that the NVQ system persists – and, indeed, has been exported to other countries – can be explained by the aggressive marketing and commercialism of the international market for pre-packaged VET commodities (Hyland 1998, 2006) combined with powerful political pressures concerned with face-saving (given the massive public investment in NVQs) and the irresistible appeal of apparently quick and easy solutions to difficult educational and economic problems. It was, for instance, obviously a rich mixture of largely noneducational and political vested interests which inspired the major project reported by Arguelles and Gonczi (2000) involving the mapping of the impact of CBET on educational systems in Mexico, Australia, New Zealand, Costa Rica, France and South Africa. The upshot of this massive public investment (with World Bank support) is summed up by Gonczi in the remarkably frank conclusion that:

> Industrial survival in the competitive workplace depends on innovative solutions to improvement which is the antithesis of prescribed procedures (as laid out in competency standards). We are left with the conclusion that the *foundation of the CBET system is shaky at best*. (p. 26, emphasis added)

In a recent major national review of all aspects of VET provision in England, the Wolf Report (2011) was highly critical of current provision – particularly for 16–19-year-olds – declaring that 'at least 350,000 get little to no benefit from the post-16 education system' (p. 7). The result is that 'many of England's 14–19 year olds do not, at present, progress successfully into either secure employment or higher-level education and training' (ibid., p. 8). In particular, the research conducted as part of the review concluded that:

> low-level vocational qualifications, notably NVQs, have, on average, absolutely no significant economic value to the holders unless they are gained as part of a completed apprenticeship. This is especially true if they were gained on a government-financed scheme. (ibid., p. 150)

Amongst the many proposals for the improvement of practice, the report recommended the delay of specialisation in terms of vocational/academic tracks until age 16, the enhancement of English and Mathematics teaching for 16–19-year-olds and – in line with Continental systems of provision – the expansion of high-quality work experience and apprenticeships for young people (ibid., pp. 160–171). Moreover, the deskilling of vocational roles via the introduction of CBET strategies which has reinforced the vocational/academic divide in Britain (Hyland 2002) has additionally resulted in the further disadvantage of young trainees pursuing competence-based qualifications as against their more privileged academic peers (Roe et al. 2006; Billett 2014).

7.5.3 *Reworking the Concept of Competence*

Against the background of the fundamental flaws of CBET systems outlined above, it is quite natural for contemporary proponents of such programmes to insist, first, that their own favoured strategies are broader and less limited than the NCVQ model and, second, that the newly modified competence systems somehow manage to transcend the difficulties uncovered in all the critical surveys. However, I think there are deep-seated problems attached to such apologetics which I hope to illustrate here in relation to attempts to apply competence strategies to the MBIs discussed earlier.

The radically behaviouristic nature of *all* CBET systems has been noted by a number of commentators (Marshall 1991; Hodkinson and Issitt 1995; Hyland 1997, 2008); thus, the attempt to change the nature of programmes based on such models by calling them 'holistic' (Hager and Beckett 1995) or as 'integrated capability' or 'situated professionalism' (Mulder 2011), though understandable in pragmatic terms, has little to recommend it. If the behaviouristic functionalism of CBET is such as to render it unsuitable for certain forms of VET or training, then why – is it legitimate to ask – not just say so and move on to more appropriate strategies? Of course, the main reason for this irrational intransigence – as hinted above – is the power of the competence slogan and its practical appeal to industry, corporate management and educators unduly concerned with quantitative educational measurement (Hyland 1998, 2008).

Lum (2009) demonstrates clearly that what really distinguishes any training strategy as competence based is the idea that the 'enterprise can be meaningfully and sufficiently specified by means of statements of outcome, performance criteria, range statements, and the like' (p. 66). I would endorse Lum's argument that this specification of outcomes is the essence of CBET, the 'singular assumption that the educational enterprise can be unequivocally, accurately and sufficiently delineated by means of such statements' (ibid. p. 67). The critical literature referred to above indicates that the search for such spurious specification of outcomes breaks down at levels beyond those of basic skills and accomplishments. The ever-increasing specification of competence statements which has attempted to solve these intractable problems has been counterproductive and fallen foul of the law of diminishing returns.

At bottom, there is a fundamental confusion here between epistemological and ontological categories of ascription. Personal qualities of character such as temperance, industry, honesty, reliability, patience and so on are fundamentally constitutive of persons – definitive of what people are – in the sense in which competencies and skills are not. The notion of a good doctor, or good chef, plumber, nurse, electrician, teacher, airline pilot, etc., is not synonymous with the idea of a person who possesses a range of skills or competencies. Such occupational roles and descriptions need to incorporate the crucial ethical and affective dimensions of working life in which virtues, dispositions, values and attitudes shape social practices in determining how people actually use the skills they have acquired in pursuing aims and goals (Hyland 1997, 2008).

Lum (2009) illustrates this general point graphically in his discussion of the difference between how CBET systems assess competence – on the basis of whether a person was able to perform a prespecified task – and how, for example, a court of law might determine the occupational competence of an employee involved in an industrial accident or dispute with an employer. In such a case, the court would be interested in far more than a person's performance in relation to CBET statements or criteria.

As Lum expresses it:

> The court's attention would be focused on what the person had received by way of training and experience, whether that person had been provided with all the information necessary to do the job safely, and so on…for CBET, competence is determined solely on the basis of performance evidence *regardless* of what someone may or may not have received by way of training, the length of time on the job, experience, etc. Clearly, the law recognizes something that the competence strategist fails to see: that the substantive extent of a person's competence may be very different from that indicated by any de facto performance, that competence cannot be presumed from the fact of such performance but must be inferred by making use of *all* available and relevant evidence. (ibid., p. 173, original italics)

Moreover, such additional evidence – and this applies to all vocational and professional roles – will require trainers and assessors to go beyond CBET systems to make use of assessment models drawn from, for example, models of teacher, medical or management education linked to higher education programmes of learning, teaching and formative assessment.

Lum concludes his critique of exclusively skill-based and competence-based practice in VET by arguing that the 'bureaucratization of education' – of which CBET is a paradigm case with its 'demand for precise specifications' – tends to compound 'two mistakes that are of devastating consequence for the educational enterprise'. These are:

> The first is to deflect attention away from the learner and his or her capabilities towards ontologies at some remove from the person. The second is to preclude from the business of assessment the very processes of inference and judgement that are so vital for making the best estimation of a person's capabilities. (ibid., p. 173)

Lum's critique – in combination with the other limitations of CBET referred to earlier – is especially pertinent to attempts to apply the competence model to general capabilities and dispositions concerned with, for example, the character, emotions and values of people. A good example of these problems is illustrated in the 'clustering competencies' model developed by Boyatzis et al. (2000) which seeks to define high-level character traits and capabilities in terms of a competence approach that can predict behaviour in the field of business leadership and management. Clusters connected with self-awareness, self-regulation, motivation, empathy, social skills, etc. (p. 348–9) are identified by the researchers.

Now, although all such qualities and traits – perhaps especially empathy, social skills conscientiousness, optimism and emotional awareness – are clearly important ingredients in management and leadership spheres (indeed, many postgraduate programmes would aim to foster them), not a single one of them can be legitimately described as competencies within the framework of standard CBET systems. It is a

classic case of overworking the competence model, trying to make it bear far more weight than it can possibly carry (cf. Hyland 1992 on 'moral competence'). Emotional awareness and empathy are affective character traits, and trustworthiness and co-operation are ethical qualities; they cannot be described as competencies without offending ordinary language.

Moreover, the argument that these higher-level traits and dispositions cannot be captured by CBET systems is not simply a linguistic quibble. The significance here is that by attempting to squeeze such qualities into CBET models – for example, by writing competence statements for loyalty, honesty, empathy, mindfulness and so on – programmes which incorporate such moral/affective components are thereby distorted and emasculated. In addition to the downgrading and deskilling on many occupational programmes following the introduction of CBET in the UK (Hyland and Winch 2007; Wolf 2011), research studies have also indicated its negative impact at the postgraduate level (Barnett 1994; Hartley 1995; Hyland 1996). An extremely telling study by Grugulis (1997) which involved the incorporation of competence techniques into a higher-level management programme concluded that the 'apparently rational and relevant competencies resulted in distinctly irrelevant activities and that, rather than representing a model of best practice, the management competencies were, at best, irrelevant and, at worst, actively harmful' (p. 428).

7.5.4 Mindfulness and Competence

The 'McMindfulness' programmes referred to earlier represent a classic case of such, often unintentional, distortion of foundational values and principles in the name of standardisation of inputs and outputs to satisfy extrinsic ends. The differences and contrasts between the mindfulness practices outlined in earlier sections and competence strategies may be illustrated graphically as follows:

Mindfulness	Competence
Process based	Product based
Informed by general principles	Directed by prescriptive statements
Ongoing, developmental	Outcome oriented
General, broad based	Specific, task oriented
Holistic	Atomistic
Fostering values and emotions	Developing skills
Informal diagnosis of progress	Formal performative assessment
Humanistic	Behavioural
Education as an ongoing journey	Education as a particular destination

Although such dichotomous features are not exhaustive of the conflicts and differences between MBIs and CBET, they do serve to characterise and highlight the chief weaknesses and problems of 'McMindfulness' approaches. Mindfulness is a subjective process involving long-term developmental learning, whereas CBET

systems are concerned with products, outcomes which can be measured, quantified and delivered to customers in the education and training market. Mindfulness traits are linked to 'being', and competence qualities are connected with 'doing' (or, rather, the measurement of doing through performance), and no amount of casuistry and rhetoric will be sufficient to paper over these radical differences.

It may well be that the MBSR workplace programmes described by Chaskalson (2011) do, in fact, enhance the well-being of employees in ways which lead to higher productivity levels in companies. If this is the case, the experiments may be continued to the benefit of all (they would certainly be discontinued if there was no economic pay-off!). However, what is being developed in such cases – as in most of the 'McMindfulness' programmes – is not mindfulness but something else: attention span, stress-related coping strategies, positive attitudes to work and so on. Against any potential gains in these areas, the losses are significant since such programmes will fail to develop the ethical and affective qualities which – on a long-term basis – have the potential for transforming VET and working practices (Stone 2014). If workplace learning is to be transformed on a more permanent basis, then programmes would need to be informed by the basic foundational qualities outlined by Kabat-Zinn (1990) and by the principles of teaching and assessment outlined by McCown et al. (2011).

7.6 Conclusions

The unfavourable comparisons between English and continental vocational education and training (VET) systems made in the Wolf Report (2011) – and indeed in many national reviews of VET in Britain since the Royal Commission on Technical Education reported in 1884 (Musgrave 1964) – point towards the low status of vocational pursuits in the UK compared to that in Continental Europe and elsewhere (Keep 2006: Hyland and Winch 2007, Pilz 2012; Billett 2014). In the light of these cultural differences, it is unlikely that structural, funding or curriculum reforms alone will succeed in enhancing VET provision without corresponding changes in the value foundation of vocational studies.

As I have argued at length elsewhere (Hyland 2002; 2014a), the upgrading of vocational studies will not be achieved by tinkering with curriculum content or assessment techniques, and the 'permanent revolution' (Keep 2006) of VET reforms over the last few decades has not succeeded in enhancing the second-class status of vocational studies. The reconstruction of VET requires a reorientation of its foundational values if the reforms proposed by Wolf (2011) and others are to have any chance of lasting success. By the same token – although European and other national systems have their own peculiar problems – the global policy agenda concerned only with cognitive outcomes expressed as behaviourist skills and competencies is, arguably, unlikely to meet the key challenges. A reconstructed model of VET needs

to emphasise the values, craft and aesthetic features of vocationalism if the perennial problems are to be dealt with adequately.

Granger (2006) makes use of Pirsig's ideas to illustrate the educational importance of Dewey's aesthetic ideas for both vocational and general education. Pirsig's (1974) description of the differences between a 'high-quality' and 'low-quality' motorcycle shop and the characteristics of a craftsmanlike mechanic are quoted by Granger. He argues that 'attending to things…means reaching out as complete beings to meet the world in a way that brings us closer to it as an equal partner in the full lived situation, and in the concrete and particular here and now' (Granger 2006, p. 118).

Such a conception of craftlike and careful work is on all fours with the non-judgemental present-moment awareness at the core of mindfulness, and Granger demonstrates forcefully the value of such notions to educational theory and practice. Such values are also incorporated in Sennett's (2008) comprehensive and painstaking analysis of the nature and significance of craftsmanship in human history. Craftsmen are 'dedicated to good work for its own sake', and all 'craftsmanship is founded on skill developed to a high degree' (p. 20). Such work is inextricably linked to codes of ethics. As Sennett explains:

> Craftsmen take pride in skills that mature. This is why simple imitation is not a sustaining satisfaction: the skill has to evolve. The slowness of craft time serves as a source of satisfaction; practice beds in, making the skill one's own. (ibid., p. 295)

This perspective on work is quite some way from the behaviourist, competence-based approach to VET and also demonstrates the crucial importance of the traditional apprenticeship system. Although this system was far from perfect, Vickerstaff's (2007) research on young people who had qualified through this route indicated the valuable socialising and developmental nature of this form of vocational training. As she notes: it 'meant something to be an apprentice: it was an expected, respected and structured path to adulthood' (p. 342) in addition to providing the long-term fostering of vocational and craft knowledge and skill. It also required the collective effort of 'family help, community backing and intergenerational support' (ibid), factors which the shorter, modern apprenticeships of recent years (Rikowski 1999) have not quite been able to achieve.

The concept of apprenticeship – like the traditional idea of craft – brings together long-term knowledge and skill development, ethical practice and social-collective involvement, all factors which are vital to the regeneration of VET at a time when, until recently, short-term skill training has held centre stage in the contemporary 'training market' (Ainley 2007). In this respect, the recent Wolf Report (2011) called for a major overhaul of the VET system in England and an increase in high-quality apprenticeships for young people (see also Keep 2012). Moreover, the conception of apprenticeship as a generic model for VET learning in all spheres is now emerging on a global level (Fuller and Unwin 2011). In this area, the recent Cavendish Report on VET in the National Health Service in the UK and the Richard Review of apprenticeships in England (Read 2013) make interesting reading. Summarising some of the key findings, Read brings out the full extent of recent

trends away from outcome-based competence and skill assessment in professional and vocational education and training towards process-oriented learning and development. As she notes, the recent reports are highly 'critical of the tick-box approach to vocational training and assessment' and recommend a new focus on 'curriculum and programme design' (2013, p. 18). The Richard Review of apprenticeships saw the purpose of apprenticeships 'not in the intricate detail of occupational standards, or the micro-level prescriptions of today's vocational qualifications' but in the development of 'new knowledge and skills' (ibid., p. 19). Along with the Wolf Report, all this can be interpreted as a critique of CBET and recommendations for a return to traditional modes of learning which aim to foster 'deep knowledge and skills' (ibid., p. 20).

Dewey's broad conception of vocational studies which 'stress the full intellectual and social meaning of a vocation' (1966, p. 316) – allied with the mindfulness and craft perspectives outlined above – are on all fours with such contemporary VET trends. The Buddhist conception of 'right livelihood' incorporates many of the core principles of craft and skill development advocated by Dewey, Pirsig, Sennett and others: precise and careful work, aesthetic and emotional appreciation, ethical procedures and links with the community. As Hanh (1999) reminds us, 'To practice Right Livelihood means to practice Right Mindfulness' (p. 116). Applying the precepts of mindfulness specifically to working life, Hanh (1991) advises us to:

> keep your attention focused on the work, be alert and ready to handle ably and intelligently any situation which may arise – this is mindfulness. There is no reason why mindfulness should be different from focusing all one's attention on one's work, to be alert and to be using one's best judgment. (Hanh 1991, p. 14)

Mindfulness is also about conducting life with skill – indeed, the notion of 'skilful means' (Keown 2005, pp. 18ff) has a special place in Buddhist ethics and practice – and the development of the central quality of present-moment awareness can assist both in enhancing vocational preparation and in connecting this to all aspects of personal and social life. The pursuit of measurable outcomes to satisfy external bodies – though naturally an important feature of national VET systems – needs to be balanced against affective goals linked to the needs and interests of learners and trainees. The introduction of mindfulness into workplace settings has served to highlight some of the tensions inherent in this sphere and has also foregrounded the importance of the holistic aspects of vocational studies.

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Chapter 8
Competence-based Education and Teacher Professional Development

Christopher Day

8.1 Introduction

The roots of competence are to be found in 'scientific management' (Taylor 1911) and what has been called 'the cult of efficiency' (Callahan 1962). At an international level, evidence for the increased emphasis by governments on teachers' instrumental effectiveness in producing prespecified and standardised outputs is demonstrated, for example, through the rise in visibility and importance of systems for measuring and comparing pupil results within and across nations in Mathematics, Science and English (PIRLS, PISA, TIMMS). At national levels, this can be seen in the increase of policies concerned with establishing national qualifications and standards for teachers at different points in their careers, tests and examinations including, in some countries, elements of 'value added' which appear to enable the measurement of pupils' progress against expectations which are established against socio-economic factors and prior attainment. Alongside this has been a further increase in 'surveillance' of teachers through, for example, performance appraisal, work scrutiny, the proliferation of target setting and external school inspection systems which place judgements of teachers' contributions to pupils' academic attainment at the centre. Schools in many countries are now able to be compared through systems of rewards and punishments. The pace and detail of governments' reform agendas are context specific but the direction of travel is the same. In short, professionalism and professional development purposes are being redefined as systems become decentralised through measures of increased organisational autonomy and made more directly accountable to government through increased systems of monitoring and evaluation in which performance itself must conform more directly to external

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rather than internal judgements of competence. However, the notion of competence has been criticised as problematic 'when either or both of two conditions are fulfilled: firstly, when competence becomes a dominant aim, so diminishing other worthwhile aims; or, secondly, when competence is construed over-narrowly' (Barnett 1994: 159).

The chapter will begin by examining, albeit briefly, a selected history of the use of the term 'competence' in the context of 'performativity', result-driven demands by governments and jurisdictions internationally for raising standards in the workplace through increased transparency, the use of more sophisticated measures of accountability and 'value for money' – what has been called the 'audit' society (Power 1997). It will then move on to consider issues of teacher professionalism in relation to the current emphasis on 'competence-based' professional development and standards.

8.2 A Short History

Although it is not possible, nor is it the purpose of this chapter, to map in detail the conceptual and developmental history of competence-based assessment in education (others have done this well, e.g. Wolf 1995, 2011), it is necessary to note its origins, forms and purposes in order to discuss its associations with and consequences for changes in the ways teachers' professionalism and their professional development are now conceived. Competence-based assessment is not new to education. For example, at least as early as 1993, competences were regarded by the British government as having 'a key role to play in building a world class workforce' (Wolf 1995: xi). It is this continuing and, in terms of the policies of many governments worldwide, ever-intensifying drive for raising standards – preferably in terms of the seductive metrics of observable and measurable results – which provides the rationale for the promotion of competences and competence-based assessment across education systems. Supported by claims of falling standards, relative to those in competitor nations, which are deemed to be incompatible with the need to increase economic competitiveness and social cohesion, successive governments have attempted to reorientate the strong liberal-humanist traditions of schooling, characterised by a belief in the intrinsic, noninstrumental value of education, towards a more functional view, characterised by competency-based, results-driven teaching (Helsby 1999: 16), payment by results and forms of indirect rule from the centre (Lawn 1996). It is also important to recognise that what has happened to education is one outcome of a larger ideological and economic pragmatism and which challenged the post-Second World War monopoly which professionals in education, health and the social services had held. For education, as for all the public services, what we are witnessing still 'is a struggle among different stakeholders over the definition of teacher professionalism and professionality for the twenty first century' (Whitty et al. 1998: 65).

Ball (2001) has described this central drive for quality and improvement as being embedded in three technologies – the market, managerialism and 'performativity' (Lyotard 1979) – and placed them in distinct contrast to the post war public welfarist state.

There are many definitions of competence-based assessment, but one that is particularly helpful is that provided many years ago by Alison Wolf:

> Competence-based assessment is a form of assessment that is derived from the specification of a set of outcomes; that so clearly states both the outcomes – general and specific – that assessors, students and interested third parties can all make reasonably objective judgements with respect to student achievement or non-achievement of these outcomes; and that certifies student progress on the basis of demonstrated achievement of these outcomes. Assessments are not tied to time served in formal educational settings… (Wolf 1995: 1)

Wolf further identified three components of competence-based assessment which are 'especially important':

1. The emphasis on outcomes – specifically, multiple outcomes, each distinctive and separately considered
2. The belief that these can and should be specified to the point where they are clear and 'transparent' – that assessors, assessees and 'third parties' should be able to understand what is being assessed, and what should be achieved.
3. The decoupling of assessment from particular institutions or learning programmes. (Wolf 1995: 2)

The notion that assessment, learning and instruction should be aligned is not new. It can be traced back to 'Taylorism' (1911) and the 'behavioural objectives' movement. This notion has been the subject of continuing criticism over the years by those whose ontological views of human agency are anchored in the idea that teaching and learning cannot and should not always be a linear, predictable process. One expression of the difference was the promotion of 'expressive' objectives and 'process models' of teaching (Eisner 1979; Stenhouse 1975) emanating from Dewey's (1933) 'ends of view' notion of learning. These kinds of objectives focus upon procedural principles of teaching which promote students' capabilities to think 'about', reflect, problem solve, imagine, understand and critique rather than developing only the functional competences necessary to meet the basic success criteria defined by the current curriculum. In short, they are used to promote qualities which are beyond those of satisfying basic education demands. The same applies to teachers. Yet, despite the measured criticisms of the narrow, atomistic, if apparently robust, learning agenda of competence-based assessment implicit in these views, all the evidence points the increased use of competences across the public services as a means of quality assuring the work of the system and the individuals within it, largely due to the increased power of managerial pressures for more transparency and contractual accountability of the workforce. Thus, 'competences' (usually though not always expressed as 'behavioural') have become part and parcel of the education landscape in many countries. They have, in the view of some, undermined teachers' traditional autonomy:

> Research has suggested that the frequent reforms in teaching…have undermined the opportunity for teachers and schools to use their discretionary competence in deciding how to plan and carry out their work, and in this way the reforms have reduced their autonomy… The attack has come from at least two sides: the introduction of new forms of management in the public sector…and the call for evidence-based practice in teaching. Research has suggested that both movements reduce teachers' autonomy though the routinization of their work, by removing the discretionary element and challenging their professional knowledge base. (Casperson 2013: 53–4)

In education systems, the consequences of the dominance of functional competence is nowhere more apparent than in the 'raw' and 'value-added' student assessments at national and international levels (OECD), teachers' performance management (aka appraisal) and external, graded school inspections. Teacher effectiveness is judged nationally and internationally against these (e.g. through the OECD and PISA reports). Moreover, student progress in pre-service (initial) teacher training is assessed in an increasing number of countries against sets of generic 'standards' (another word for competences). In the UK, this is then linked to other national sets of role performance standards (criterion-based assessment) as teachers and head teachers move through their careers. It should not be surprising, then, that much professional development work is now aligned more closely than ever with the perceived need to raise levels of students' measurable attainment in line with government targets, since their results are key indicators in judgements about the relative quality of education provided by schools. Whilst over the years, competences have been primarily associated with further and vocational education (e.g. National Vocational Qualifications), they have been seen traditionally in the workplace in general as a means of identifying and measuring skills necessary either for carrying out a job at a number of defined levels or/and as measures of the extent to which jobs are carried out successfully.

However, in the strong theoretical case for limiting the use of competency models, the fact is that: 'It is almost inevitable that the more important formal qualifications become, the more they will be expected to concur with the norms of formal fairness and transparency of rules' (Wolf 1995: 35).

This brief tour of the landscapes of competency developments has been conducted not in order to discuss their use or usefulness but rather to identify both their strengths (identification and delineation of appropriate qualities, knowledge, skills associated with expectations and standards in the workplace; provide a means of differentiation, monitoring and audit) and limitations (atomistic, potentially reductionist, oversimplified and unable always to be applied as a means for judging quality in contexts which require the possession and sustained application of complex, situation related and contingent cognitive and emotional human relating and decision-making, i.e. the teaching profession). In relation to professional development, there are difficulties, also, in measuring emotional competence which is, arguably, an essential feature of the work of teachers.

8.3 Extending the Meaning of Competence in Professional Development: A Work in Progress?

At least to the author of this chapter, critiques of both the underpinning justification for and application of competence-based education and 'training' advocates would seem to be entirely reasonable. However, they have been insufficient in themselves to stem the growth of the use of competency-based approaches in education, as levels of trust in teaching professionals in many countries have decreased and

demands for accountabilities and answerabilities at all levels have increased. Critiques have 'not so much been rebutted as disregarded, and theoretical concerns deposed in favour of supposedly more pragmatic priorities', as CBET (competence-based education and training), have 'spread into almost every area of contemporary educational discourse in the UK' (Lum 1999: 403).

In writing about competence-based teacher education, Whitty and Willmott (1991) were able to claim that 'no consensus has yet emerged about the meaning of 'competence', let alone agreement about the specific competences that should be engendered by initial teacher education or INSET (in-service education and teaching) courses' (p. 309–310). They cited the work of Hextall and his colleagues (1991) who argued that 'teaching is not reducible to a set of technical operations' (p. 15) and claim that competence-based teacher education 'encourages an over-emphasis on skills and techniques' (p. 310). They identified two 'major' approaches to the definition of competence:

– 'Competence characterised as an ability to perform a task satisfactorily, the task being clearly defined and the criteria of success being set out alongside this.
– Competence characterised as wider than this, encompassing intellectual, cognitive and attitudinal dimensions, as well as performance; in the model, neither competences nor the criteria of achievement are so readily susceptible to sharp and discrete identification' (p. 310).

Yet these major approaches are in evidence almost 30 years later, and, whilst the contexts of teacher education and teaching have changed in the intervening period, the debate continues between: (i) those who argue that to characterise teaching as being able to be reduced to a given number of discrete skills is reductionist, potentially reducing the role of teacher to that of a technician, and (ii) those who argue that it is necessary to identify such skills as public criteria for course design, teaching and assessment for quality assurance purposes. Such quality assurance, it is argued, is a necessary part of identifying a minimum or threshold standards for teacher education, teachers and classroom teaching and/or a means of identifying and judging performance expectations for teacher in different roles and levels of achieved performance for purposes of assessment and promotion.

Over the years many education systems have developed what appear to be more inclusive definitions of competence-based teacher education. One example, from Flanders, can be seen in Table 8.1 below.

These functional components and attitudes were produced for use in 1998 yet, according to Struyven and De Myst's (2010) research, more than a decade later, are 'still a work in progress' (p. 1506). When examined closely, it is perhaps unsurprising that the high ambitions contained in many items, e.g. 'teacher as innovator – the teacher as researcher', 'the teacher as culture participant', 'creative orientation', 'eagerness to learn', may not be able to be easily assessed or uniformly realised. Perhaps more importantly, there seems to be no consideration of the positive or negative influences of personal, workplace and life passage change factors on the motivation, commitment and capabilities of teachers to achieve competence. So whilst this and other similarly well-intentioned frameworks appear to take into

Table 8.1 Overview of the ten functional components and ten attitudes for (beginning) teachers in Flanders' teacher education (decree of 1998), organised by cluster of responsibility (Aelterman 1995)

Basic competences for teacher education BC = FC + (each of the) attitudes			
10 functional components for (beginning) teachers		10 attitudes	
Responsibility for the learner			
01	*The teacher as a guide of learning and development processes*	A1	*Decisiveness*
	Defining the initial situation and selecting learning goals		The teacher dares to take a stand and acts on it in a responsible manner
	Designing powerful learning environments		
	Assessment for learning and of learning		
	Meeting cultural diversity and special needs in learning		
02	*The teacher as educator*	A2	*Relational orientation*
	Providing a positive climate		In his contacts with others, the teacher is genuine, true and heartfelt
	Emancipating children		
	Meeting diversity and (special) needs in emotion and relation		
	Education in norms and values		
03	*The teacher as subject expert*	A3	*Critical reflection*
	Being knowledgeable about and skilled in a domain(s) of expertise		The teacher is prepared to question himself and the environment and verifies the value of an opinion or event, the desirability and feasibility of learning goals, before taking a stand (making decisions and acting on them)
04	*The teacher as organiser*	A4	*Eagerness to learn*
	Classroom management		The teacher actively explores situations and initiatives to broaden his professionalism
	Administrative work		
05	*The teacher as innovator – the teacher as researcher*	A5	*Organisational skills*
	Learning from experience and from collaboration with others		The teacher wants to plan, coordinate and delegate his tasks in order to efficiently attain his goals
	Reflective practitioner		
	Design research/action research/ practice-based research		
Responsibility for the school and educational community			
06	*The teacher as partner of the parents/carers*	A6	*Sense of collaboration*
	Discrete and confidential about personal information		The teacher is prepared to work at joint tasks collegially
	Communication with (diversity of) parents		

(continued)

Table 8.1 (continued)

Basic competences for teacher education BC = FC + (each of the) attitudes			
10 functional components for (beginning) teachers		10 attitudes	
07	*The teacher as member of a teaching team*	A7	*Sense of responsibility*
	Consult and work together with other team members		The teacher feels responsible for his schools and engages to enhance a positive development with learners
	Discussing (own) approaches to teaching with colleagues		
08	*The teacher as part of external parties*	A8	*Creative orientation*
	Communicate and work together with parties that offer education-related support (e.g. to students or teachers)		The teacher should be creative and innovative in dealing with situations
09	*The teacher as member of the educational community*	A9	*Flexibility*
	Participation in debate on teaching and education		The teacher easily adapts to changing circumstances
Responsibility for society			
10	*The teacher as culture participant*	A10	*Orientation towards a correct and appropriate use of language and communication*
	Perception of and critical approach towards topical matters in different domains: political, economic, philosophical, esthetical, scientific and cultural		The teacher uses language correctly, appropriately, adaptively and respectfully dependent on the receiver and situation

account the complexities of teaching and teachers' lives, the ways in which they are constructed for use limits and may even distort the quality of the judgements which are made. In short, competency-based measures of assessment, when applied to the complex lives of professionals, do not always measure what they should in settings where 'know-how' and 'knowing why' are as important as 'knowing what'. As yet, then, it remains the case that:

> the capacity of CBET to substantially achieve its ends, given that competence is conceived in such comprehensive terms, is an entirely contingent matter and one which remains to be demonstrated [i.e. there is no necessary correspondence between competence as an aim and the so-called 'competencies' which constitute CBET's modus operandi]. (Lum 1999: 407)

8.4 Standards: Competences Re-named?

Perhaps the most significant development and application of competences to teachers and teaching has been their reconfiguration in what seems to be the more benign form of 'standards'. The development and use of specified 'standards' in assessing the performance of professions may be seen as an acknowledgement of the

complexity of their work and a tacit recognition that simple metrics are not adequate. For example, teacher standards in England are divided into 8 parts, each with a number of subsections (DfE 2013). Teachers are expected to:

1. Set high expectations which inspire, motivate and challenge pupils
2. Promote good progress and outcomes by pupils
3. Demonstrate good subject and curriculum knowledge
4. Plan and teach well-structured lessons
5. Adapt teaching to respond to the strengths and needs of all pupils
6. Make accurate and productive use of assessment
7. Manage behaviour effectively to ensure a good and safe learning environment
8. Fulfil wider professional responsibilities

Meeting and exceeding these standards is a central part of annual appraisal and contributes internally to career advancement and externally to judgements made about the quality of teaching and learning. The question in this chapter, however, is the extent to which they are matched by the professional development opportunities provided and to what extent they meet the claim that competence-based education is creating opportunities for students and workers: 'Competence-based education is creating opportunities for students and workers, close to their world of experience in a meaningful learning environment (preferable the professional practice) wherein the learner can develop integrated, performance-oriented capabilities to handle the problems in practice' (Wesselink et al. 2003: 3–5).

In one sense, the presence of professional standards and qualifications may be seen as an addition to the status of teaching as an occupation – not everyone can gain entrance or progress equally along a defined career trajectory and those who do must demonstrate that they can meet sets of nationally defined 'fit for purpose' criteria. Superficially, they act as 'quality-assured' mechanisms for ensuring that their students in school will receive at least 'competent' and perhaps, also, 'good' or 'outstanding' teaching by skilled practitioners. In this sense, also, 'competence-based' assessment seems to fit with professional development opportunities which have been put into place by governments in the ongoing development of 'self-improving' school systems.

8.5 Capability: An Alternative to Competence?

Essentially, the debate about the purpose, efficacy and practical value of competence-based approaches in the education sphere is a debate both among educationists (the philosophical dimension) about the nature of human capability, whether and how such human capabilities may be represented and between educationalists and politicians (the political dimension). For example, if we were to agree with Polanyi's (1983) view that much of human knowledge is 'implicit' as 'We can know more than we can tell' (p. 4) or that of Schön (1996) that 'Often, we cannot say what it is that we know' (p. 49), and then we might also agree with Halliday (1996, p. 54 cited

in Lum 1999, p. 411) that 'written descriptions of behaviour may be seen as substitutes for the elusive notion of objective reality' (p. 54). This would be countered to the claim of so-called empiricist assumptions that features of human capabilities can be identified and assessed through collections of competences (whether behaviour or otherwise) that are 'ontologically objective'. The proponents of the former would, to the contrary, claim that reality is socially constructed and ontologically subjective and that the understanding and judgement of 'competences' are entirely dependent upon human agreement. For example, Lum (1999) concludes his paper on 'Where's the competence in competence-based Education and Training?' with 'two fundamental assumptions between which the competence strategist can be seen to vacillate' (p. 413): 'i. The assumption that human capabilities are intrinsic, ontologically objective features of the world; ii. The assumption that it is possible for statements to unequivocally, accurately and sufficiently describe ontologically subjective/epistemologically objectively features of the world' (ibid. pp.413–4).

Amartya Sen (1985) posits a contrasting view of human development to the proponents of competences. Sen's work is primarily intended as both a critique of utilitarianism and inequality, arguing that individuals are the 'primary objects of moral concern' (Brighouse and Swift 2003: 358).

Sen's work is relevant to education, not least because it focuses attention on achievements in terms of the teacher as a person as well as a functionary. 'A person's capability refers to the alternative combinations of functionings that are feasible for her to achieve. Capability is thus a kind of freedom: the substantive freedom to achieve alternative functioning combinations' (Sen 1999: 75).

Whilst competences seem to be more inclusive than earlier behaviourist definitions, in contrast to Amartya Sen's conceptualisation of 'human capability', they are defined by those who advocate competences essentially in functionalist terms. They are 'clusters of knowledge structures and also cognitive, interactive, affective and… attitudes and values, which are conditional for carrying out tasks, solving problems and effectively functioning in a certain profession, organisation, position and role' (Wesselink et al. 2003: 3–5). A distinctive feature of Sen's 'human capability' approach is that it focuses upon, 'the *state* of the person, distinguishing it both from the *commodities* that help generate that state, and from the *utilities* generated by the state' (Sen 1993: 43). In terms of teachers and teaching, whether in schools, further education or higher education, this is important, for the ability to stimulate, motivate, engage and interact is key factor in influencing students' learning and achievement.

If a key purpose of school education is to enrich the lives of students (Flores-Crespo 2004: 45) by, for example, promoting critical reflection and active engagement in their own learning and, through these, the ability to exercise personal autonomy rather than passive compliance, then fostering 'capability' in teachers also, rather than 'functionalism' only, becomes important. Education then becomes the 'practice of freedom':

> Education as the practice of freedom – as opposed to education as the practice of domination – denies that man is abstract, isolated, independent, and unattached to the world; it also denies that the world exists as a reality apart from people. Authentic reflection considers neither abstract man nor the world without people, but people in their relations with the world. (Freire 1972: 62)

The notion of 'capability', then, may be seen as expanding the possibilities for teachers and, by association, students to be 'responsible agents who can alter their destiny' (Flores-Crespo 2004: 49). Sen's work draws attention to the purposes of education as both 'a form of functioning or well-being achievement, for example, completing…basic education in a school'…[and]…as part of a process of exercising agency, that is, using reflection, information, understanding, and the recognition of one's right to exercise these capacities'(Flores-Crespo 2004: 49).

8.6 Professionalism and Professional Development: Functionality or Capability?

It is widely acknowledged that, 'the quality of education depends to a large extent on the quality of teaching staff, which in turn depends on their participation in CPD activities, at least partly'(Seezink and Poell 2010: 471). Participation in lifelong learning has long been associated with the meanings of professionalism, the subject of many studies over the last century. Adopting a macro perspective, Andy Hargreaves has presented the development of professionalism as passing through four historical ages in many countries – the 'pre-professional' (managerially demanding but technically simple in terms of pedagogy), the 'autonomous' (marked by a challenge to the uniform view of pedagogy, teacher individualism in and wide areas for discretionary decision-taking), 'collegial' (the building of strong collaborative cultures alongside role expansion, diffusion and intensification) and the 'post-professional' (where teachers struggle to counter centralised curricula, testing regimes and external surveillance and the economic imperatives of marketisation) (Hargreaves 2000: 153). Essentially, his work and that of other researchers (Helsby 1996; Robertson 1996; Talbert and McLaughlin 1996) illustrate the growth of challenges from governments to teachers' agency and a contestation of control of curriculum content, pedagogy and assessment historically associated with teacher professionalism.

Yet, 'being a professional' is still seen as an expectation placed upon teachers, which distinguishes them from other groups of workers. Professionalism in this sense has been associated with having a strong technical culture (knowledge base), service ethic (commitment to serving clients' needs), professional commitment (strong individual and collective identities) and professional autonomy (control over classroom practice) (Etzioni 1969; Larson 1977; Talbert and McLaughlin 1996). As we have seen, however, the emphasis on corporate management which many reforms produce has resulted in a sea change in how professionals are identified and judged. Each teacher must now be a:

> professional who clearly meets corporate goals, set elsewhere, manages a range of students well and documents their achievements and problems for public accountability purposes. The criteria of the successful professional in this corporate model is one who works efficiently and effectively in meeting the standardised criteria set for the accomplishment of both students and teachers, as well as contributing to the school's formal accountability processes. (Brennan 1996: 22)

So the issue is not whether competence-based development itself is an intrinsically valuable and worthwhile pursuit but whether its dominance distorts and detracts from the notion of teacher professionalism and the improved practices of teachers and teaching. Teachers' pre-service and in-service professional development programmes have, perhaps not surprisingly, become increasingly associated with the need to 'perform' at individual and whole-school levels through compliance with the main strands of the new public management agenda, and it has been argued by some that much less attention is now being given to teachers' broader commitment and emotional and motivational needs. A key question in this chapter, therefore, is what are the professional responsibilities of individual teachers and schools and how may these be best sustained over the course of their careers in contexts in which accountability and performativity imperatives dominate. It may be that, as Cohn and Kottkamp observed:

> Power and authority….is being taken away from the teacher. Now, everything is mandated to you. You have no freedom to venture out; you want to be creative with the kids, and you want to do things. You don't want to be so routinized….But you're accountable for so much, so many things. (Cohn and Kottkamp 1993:140)

In presenting an alternative and more agential view of teachers, Sachs (2003) identified two contrasting forms of professional identity:

- Entrepreneurial, which she identifies with efficient, responsible, accountable teachers who demonstrate compliance to externally imposed policy imperatives with consistently high-quality teaching as measured by externally set performance indicators. This identity may be characterised as being individualistic, competitive, controlling and regulative, externally defined, standards led.
- Activist, which she sees as driven by a belief in the importance of mobilising teachers in the best interests of student learning and improving the conditions in which this can occur. In this identity, teachers will be primarily concerned with creating and putting into place standards and processes which give students democratic experiences.

The former, she argued, is the desired product of the performativity, managerialist agendas, whilst the latter suggests inquiry-oriented, collaborative classrooms and schools in which teaching is related to broad societal ideals and values and in which the purposes of teaching and learning transcend the narrow instrumentalism of current reform agendas.

We can apply these different understandings of professionalism to the design and practices and content of teachers' continuing professional development. There, we might expect to see approaches which include a focus upon functionalities but also upon the central human capabilities which, according to Nussbaum (2000), need to be present for a 'fully human good life' (Walker and Unterhalter 2007: 13): bodily health; bodily integrity; senses; imagination and thought; emotions; practical reason; affiliation; other species; play; and control over one's environment (Nussbaum 2000: 78–80), for it may be argued that these are the capabilities which teachers need in order to be able to be at their most effective in the classroom. As emphasised by the European Commission (2012: 8–9):

> Teaching competencies are thus complex combinations of knowledge, understanding, values and attitudes, leading to effective action in situations […] The range and complexity of competencies required for teaching in actual societies is so great that any one individual is unlikely to have them all, nor to have developed them all to the same high degree […] Teachers' continuous professional development is, thus, highly relevant both for improving educational performance and effectiveness and for enhancing teachers' commitment. (European Commission 2012: 8–9)

Although, as reported in TALIS (2013: 99), 'empirical evidence increasingly shows the positive impact of teachers' professional development on students' scores (Hill 2013; Yoon et al. 2007), measurements of enhanced teachers' commitment competence, identified as a key factor in teachers' perceived ability to teach to their best (Day et al. 2007), are elusive. Indeed, the types of professional development identified as most common in TALIS (2013: 108) are principally instrumental in their orientation: (i) knowledge and understanding of subject fields, (ii) pedagogical competence in the teaching subject field, (iii) student evaluation and assessment practices, (iv) knowledge of the curriculum, (v) ICT skills for teaching, (vi) student behaviour and classroom management, (vii) approaches to individual learning, (viii) new technologies in the workplace, (ix) teaching cross-curricular skills (e.g. problem-solving, learning to learn), (x) teaching students with special needs, (xi) student career guidance and counselling, (xii) approaches to developing cross occupational competences for further work and studies, (xiii) school management and administration, and (xiv) teaching in a multicultural or multilingual setting. It is noticeable that the methodology employed by OECD in the TALIS (2013) study did not include questions regarding, for example, commitment, resilience, motivation or reflection.

A key problem with traditional representations of competency approaches is that of the tendency towards allowing 'functionings' to dominate because they appear to be observable skills and behaviours which can be most readily used by employers and prospective employers as 'baseline data' which can then be used to assess job demands, inform judgments about individual performance levels and their relative performance against others, i.e. the achieved outcomes of individuals in relation to their work roles which are defined by employer-defined work demands related to observable products. Despite the inclusion in many competence-based instruments of 'softer' values, attitudes and qualities in, for example, teaching 'standards', these are much less easy to quantify and so, in this sense, less reliable as indicators of quality. We should remember that not everything that can be measured is valuable and that much of what is valuable, especially in the 'human-related' professions, is difficult to quantify.

8.7 Conclusions

There is nothing wrong with identifying and even atomising particular 'role' and 'job' competences, or indeed defining and refining the means by which they might be assessed, provided always that there is a recognition that (i) atomisation of

knowledge and skills does not lend itself to the requirement to teach well and that (ii) professional development programmes need to define clearly whether they are for the primary purpose of *training*, e.g. through coaching particular skills; *development*, e.g. through critical appraisal of aspects of teaching and learning; or *renewal*, e.g. with a focus upon capacity building for commitment and resilience. Brundrett and Silcock (2002) summarised this well in their wide-ranging review of competences in education, concluding that:

> Despite all this revisionism and continuing optimism expressed by supporters, the worm eating away the core of the competence approach is that it unashamedly offers *training* rather than *education* whereas training endeavours to impart knowledge, skills and attitudes necessary to perform job-related tasks and to improve job performance in a direct way, education is a process whose prime purposes are to impart knowledge and develop cognitive abilities applicable to all important life-situations. In this sense, education is not primarily concerned with job performance, it is concerned with the deployment of more subtle and flexible human capabilities for dealing with fleeting problems, seldom vulnerable to trained skills…specifically, teachers need broad intellectual abilities to solve the most severe problems currently facing schools. (Brundrett and Silcock 2002: 107–108)

Judyth Sachs's (2011) metaphors of continuing professional development are particularly useful in purposeful planning.

1. *CPD as retooling*. This is seen as the dominant training model, based upon a 'practical' competency view of teaching in which ideas, knowledge and techniques learned can be immediately applied to the classroom. It represents 'a skill-based, technocratic view of teaching' (Kennedy 2005: 237) and 'is likely to promote a limited conception of teaching and being a teacher' (Day 1999: 139).
2. *CPD as remodelling*. This is seen by Sachs as being 'more concerned with modifying existing practices to ensure that teachers are compliant with government change agendas…[it]…reinforces the idea of the teacher as the uncritical consumer of knowledge and operating at the level of improving specific skills as these relate to immediate classroom practice' (2011: 5).
3. *CPD as revitalising*. Here the focus is upon teacher renewal, providing opportunities for teachers to reflect upon why they came into teaching in the first place, and examining beliefs and practices, perhaps through professional development networks, or participation in practice-based enquiries.
4. *CPD as reimagining.* This represents what Sachs calls 'a transformative view of teacher professionalism' (2011: 7) which acknowledges the complexities of being a teacher. It seeks to develop in teachers their own 'critical and transformative capacities' (2011: 7). Here, teachers may participate in collaborative activities in collegial environments which 'support open minded inquiry, reflection… they support teachers in validating their knowledge and building on it' (2011: 8).

The first two are oriented towards 'training', the third and fourth towards teacher learning. Experience and research, then, suggest that the emphasis on behaviourally focussed competency-based models of the work of teaching does not represent well their work but at worst ignores and at best under values the reality of their work. Rather, teachers at their best combine their professional craft expertise with their

personal commitment, care, experience, passion, emotional understandings and values in their work; and the possession and deployment of these are difficult to measure.

If we look a little further at the research literature which examines the nature of teaching and learning, we see a different picture which may cause us to question the implicit definition of teaching and learning in classrooms and the nature of professionalism provided in the competences' section above and perhaps there is a glimmer of light to be seen in the report of the New Commission on the Skills of the American Workforce (2001) reported that:

> We need to bring what we teach and how we teach into the 21st century. Right now we're aiming too low. Competency in reading and math – the focus of so much 'No Child Left Behind' testing – is the meagre minimum. Scientific and technical skills are, likewise, utterly necessary but insufficient. Today's economy demands not only a high-level competence in the traditional academic disciplines but also what might be called 21st century skills. (Wallis and Steptoe 2006: 51)

As long ago as 1987, Lee Shulman described teaching as, 'The exercise of judgement under conditions of unavoidable uncertainty' (1998: 9); however, Shulman did not then differentiate between 'teaching' as craft and 'good' teaching as 'artistry' in addition to 'craft'. Eisner, alongside many other scholars, claimed that good teaching depends not only on knowledge and skills but also upon intuition, aesthetic considerations and pedagogical tact and that the exercise of these requires a synthesis of imagination, intellect and emotion:

> Artistry does not reduce complexity, it has a tendency to increase complexity by recognising subtlety and emphasising individuality. It does not search for the one best method. It puts a premium on productive idiosyncrasy. It is crucial complement to getting it down to a science. In the vernacular, 'getting it down to a science' means, ideally, getting it down to an errorless procedure. A procedure becomes errorless when there are no surprises. When there are no surprises there is no problem. When there is no problem, there is neither challenge nor growth. Artistry is teaching as a pervasive concept goes beyond routine, invites risk, courts challenges and fosters growth. (Eisner 1996: 18)

Much later, in his much acclaimed meta-analysis relating to the influences in student achievement, John Hattie (2009) made a similar observation. Referring to 'passion' rather than 'artistry', he writes:

> We rarely talk about passion in education, as if doing so makes the work of teachers seem less serious, more emotional than cognitive, somewhat biased or of lesser importance…The key components of passion for the teacher for the learner appear to be the sheer thrill of being a learner or teacher, the absorption that that accompanies the process of teaching and learning, the sensations of being involved in the activity of teaching and learning, and the willingness to be involved in deliberate practice to attain understanding…it infuses many of the influences that make a difference to the outcomes. It requires more than content knowledge, acts of skills teaching, or engaged students to make the difference.

In a changing world, basic sets of competences acquired in the pre-service 'training for work' context will be insufficient to building and sustaining quality in teaching. Teaching itself is more than a scientific or technical occupation. To teach well requires 'professional capital'. This is an amalgam of 'human, social and decisional'

capital (Hargreaves and Fullan 2012: 3). It represents the capability and capacity to apply fit for purpose, timely, social, decisional and personal capital which contain both educational values, intellectual and emotional understandings. In considering the limitations of relying upon the identification and teaching of competences defined as skills, their definition of 'decisional capital' is especially appropriate: 'the capital that professionals acquire and accumulate through structured and unstructured experience, practice and reflection – capital that enables them to make wise judgements in circumstances where there is no fixed rule or piece of incontrovertible evidence to guide them' (Hargreaves and Fullan 2012: 93–4).

One way of defining 'wise' in relation to 'discretionary capital' is to consider the complexity of decision-making processes by 'experts' in the classroom. Research by Eraut et al. (2000) identified five elements of workplace decision-making:

- Experts frequently generate and evaluate a single option rather than multiple options.
- Experts are distinguished from novices mainly by their situational assessment abilities, not their general reasoning skills.
- Because most naturalistic decision problems are ill structured, decision-makers choose an option that is good enough, though not necessarily the best.
- Reasoning and acting are interleaved, rather than segregated.

> Instead of analysing all facets of a situation, making a decision and then acting, it appears that in complex realistic situations people think a little, act a little and then evaluate the outcomes and think and act some more. (Eraut et al. 2000: 5)

Paradoxically, measures of 'accountability' for the quality of teachers' work have become more narrowly focussed and transparent, so too has the emphasis upon more personalised, deeper learning opportunities for students. So, with the recognition that teaching itself is ever more complex have come new understandings across many systems of education that a competency-based systems of professional development must provide opportunities for teachers themselves to engage in deeper learning which includes but goes beyond the use of strong data systems and knowledge of external requirements related to standards. Moreover, whilst it is important to acknowledge that different qualities and competences might be usefully defined in relation to career progression, it is equally important to recognise that, as with students, so teacher motivation, commitment and resilience may fluctuate within and across different professional life phase (Day et al. 2007), as will teachers' sense of professional identity: and with these the capacity not only to teach well but also to their best.

So we learn from this that teaching is more than the sum of competences; however, these may be defined and that professional development opportunities and activities should reflect this. Narrowly defined competences are only one part of the necessary toolkit which teachers need in order to teach to their best. In order to exercise 'discretionary capital' (Hargreaves and Fullan 2012) they need, as Eisner, Hattie, Hargreaves, Shulman and many other reputable researchers down the years have noted, to be able to 'read' and understand the classroom, school, pupil and

policy contexts in which they work, to exercise 'wise' judgements. They need, also, to be motivated and committed (to their subjects, to their students, to their colleagues), and they need to have capacities for hope, academic optimism and resilience which encompass but go beyond narrowly defined competences.

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Chapter 9
Beyond Competence, Thinking Through the Changes: Economy, Work and Neo-liberalism

James Avis

9.1 Introduction

The chapter considers workplace learning (WPL), conceptualisations of competence and theorisations of cognitive capitalism. This discussion needs to be set within the wider socio-economic context characterised by an increasingly turbulent environment in which the old certainties surrounding industrial Fordism of jobs for life have been found wanting. This has been particularly the case in societies closely wedded to neo-liberalism such as the US and UK. These societies are marked by significant inequalities of wealth and income, polarised labour markets, as well as substantial levels of underemployment, unemployment and overqualification. Economic turbulence allied to underemployment, unemployment and overqualification has been a long-standing characteristic of waged labour in the emerging economies and is also found in continental Europe, even though the hegemony of neo-liberalism is in some instances somewhat softened. For some writers the logic of capitalist development anticipates forms of social production which carry progressive possibilities, whereas for others the prognostication is much bleaker (Adler and Heckscher 2006; Engeström 2010). The chapter explores these debates as they serve to frame the manner in which we make sense of and engage with notions of competence and knowledge. The chapter draws on discussions of vocationalism, vocational pedagogy as well as the constitution of vocational knowledge, debates set within particular historic, socio-economic and national contexts. It points towards the limitations of analyses of workplace learning and in so doing draws upon conceptualisations of 'really useful knowledge' and subject-based disciplinary knowledge. Workplace learning can easily fold over into an instrumentalism concerned with enhancing variable labour power. The

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chapter argues for recognition of the articulation between practice-based and employer interests in VET, set against wider disciplinary understandings and access to powerful and transformative knowledge. It is suggested that disciplinary knowledge, when allied to workplace experience, can be appropriated by oppressed and marginalised groups, thereby becoming 'really useful knowledge" to be marshalled in the struggle for social justice. This then is the pedagogic challenge to open up possibilities that themselves presage not only the transformation of practice but also social relations.

This chapter seeks to synthesise literature that has addressed workplace learning, competence as well as changes in the capitalist mode of production. There is a particular difficulty in the analysis of competence and its relationship to capitalism. This arises in part as a consequence of the level of the analysis with the notion being derived from and related to specific social formations and in part because of this specificity as well as the very fluidity of the term. The notion of competence, as Sawchuk (2009) suggests, is a floating signifier with its meaning varying over time, from society to society, as well as in relation to the particular occupational tasks addressed (see Winterton 2009; Mitchell and Boak 2009). Not only do we encounter this fluidity, but the term is embedded in vocational education and training policy discourse in distinctive ways. Thus, the notion of competence will carry varying meanings in different VET systems and can straddle narrow job-specific definitions, as found in Anglo-Saxon models, to more holistic ones as seen in Germany and Holland (see Mulder et al. 2009). Alongside these differences shaped by national VET systems, the European Qualification Framework seeks to create a structure based on learning outcomes that aims to facilitate labour mobility across the union (for discussion see Méhaut and Winch 2012). This is not withstanding national variations in the way in which competence is conceived and enacted in VET training systems. Brockmann et al. (2009, 2011) have usefully explored the different linguistic meanings attached to the term across the EU and in particular those found in English, French, Dutch and German (see also other papers in the 2009 Special Issue of the *Journal of European Industrial Training*).

This chapter seeks to explore the limits and possibilities of competence for its social justice and progressive possibilities. It considers whether the term is so wedded to capitalist interests that it is necessarily compromised. In addition, it raises the question of the way in which we should make sense of competence in the new socio-economic conditions currently faced. Do we need to go beyond the term despite the progressive readings that some have attached to it? However, the first task is to examine conceptualisations of competence.

9.2 Conceptualisations of Competence

Below are different conceptualisations of competence which have been selected to illustrate the range of understandings attributed to the term. The first is based on Mulder's description of Dewey's stance towards competence that aligned this not only to work but also to citizenship and democratic participation in wider society.

> Dewey saw competency as the general public did, as the ability to create a livelihood, but also as the minimum requirement to enable the pursuit of an independent career that is chosen in freedom, the broad mastery of professionalism which needs to be related to citizenship, which enables people to participate in the democratic society and a vocation or profession in a self-determined way. (Mulder 2014, 112–113)

In Biemans et al.'s conceptualisation, there is a tighter focus on the capacity of an individual or indeed organisation to attain a specific goal, but as with the previous citation, the notion of competence may be extended beyond the workplace to its value and attitudinal dimensions.

> 'Competence' is the capability of a person (or an organisation) to reach specific achievements. Personal competencies comprise integrated performance-oriented capabilities, which consist of clusters of knowledge structures and also cognitive, interactive, affective and where necessary psychomotor capabilities and attitudes and values, which are required for carrying out tasks, solving problems and more generally, effectively functioning in a certain profession, organisation, position or 'role'. (Biemans et al. 2009, 273)

In contradistinction, Sandberg mobilises a socially situated construction of competence, referring to the understandings workers' attach to work.

> The basic meaning structures of workers' conceptions of their work constitutes human competence. It is workers ways of conceiving work that make up, form, and organise their knowledge and skills into distinctive competences in performing their work. (Sandberg 2000, 20)

Finally, from a rather different stance and in a discussion of social unionism and skill/competence, Sawchuk refers to 'build[ing] practical capacity to transcend current labour processes, job and technological design for greater economic democracy' (2009, 137).

The above addresses competent work performance, the collective and individual processes involved as well as the space for innovation and creativity that goes beyond existing practice, anticipating not only the transformation of workplace processes but also wider society. However, caution needs to be exercised when considering this reading of competence. On one level it ignores narrow conceptualisations whilst on another plays down the manner in which capital appropriates and colonises worker skills. Questions of power and control need to be at the forefront of analyses together with an acknowledgement of the on-going transformation of capitalist relations as these seek to adapt to new conditions in order to secure the interests of capital.

Importantly, the capitalist mode of production is not all of a piece, and whilst much is made of its transformations, these should be understood in terms of its 'evolution' set alongside sedimentations of the past. In other words, earlier forms of production will exist alongside those that are emerging. Thus, for example, Fordist forms of work organisation will coexist with post-Fordist ones, each drawing upon particular conceptualisations of competence. Amazon would be a good illustration of this with extensive use made of digital technologies alongside the deployment of Fordist labour processes in their warehouses. The latter has a strong resonance with Taylorist scientific management, with its detailed division of labour (Taylor 1911;

Datoo 2013). This is similarly the case with subsequent developments in capitalism where different forms of production exist side by side.

Much has been made of notions such as the knowledge, information or networked society that carry implications for the manner in which competences are conceived as well as their mobilisation in work-based processes. Here notions of creativity and innovation are drawn upon, though such processes are set within the relations of power present in the workplace; after all capital has always sought to appropriate variable labour power. Because of its evasion of capitalist antagonisms, the argument that post-Fordism was able to overcome the oppressions and exploitations embedded in Fordist work relations has been subject to extensive critique. However, there are particular analytic currents in radical thought that assert that knowledge-based economies (KBEs) hold within them not only radical but also transformative possibilities flowing from developments in the forces of production and changes in the way surplus value is generated. Such arguments tend to be located within what could be described as the knowledge economy and creative industries. These arguments are interrogated, and it is suggested, as with earlier discussions of Fordism and post-Fordism, that such processes are amenable to capitalist appropriation.

It is relatively easy to associate behaviourist models of competence, as seen in western societies with Fordism – the apogee of industrial capitalism, and to link this with social-democratic welfarism. In this, a context characterised by mass production and consumption, there was an affinity between behaviourist models of competence and a detailed division of labour in which tasks were broken down into a series of discrete elements. Such approaches to competence have been criticised for their overspecification and fragmentation of tasks (Mulder 2014, 129) as well as for the manner in which they atomise and simplify working relations (Bound and Lin 2013, 403). In addition they veer towards a 'technical functionalism' (Elleström and Kock 2009, 38) that is predicated upon a model of consensus that plays down wider social antagonisms between labour and capital. Through the simplification of workplace activities, behaviourist models ignore the complexity of work, the decisions that are taken and the judgements (Beckett 2009) made, in what may appear at first sight to be simple tasks. It is important to remind ourselves that it is through the exercise of variable labour power that surplus value is accrued by capital.

The increasing salience of competence as well as the development of more collective and holistic understandings of the term arose as a result of a number of factors. These include the putative decline of industrial capitalism in the west, the increasing importance attached to knowledge and creativity as well as the secular failure of education to 'produce' the forms of labour required by employers. Consequently cognitive and generic understandings of competence developed alongside those that emphasise the importance of socially situated practices. In the latter case, competences are articulated with the specificity of the workplace, set within a particular temporal and social location that necessitates the mobilisation of particular skills, knowledge and affect. The broader context in which these changes are placed is one in which post-Fordist rhetoric becomes significant, resting alongside the notion of the knowledge worker and the emerging hegemony of neo-liberalism.

Thus, we encounter discussions concerned with the development of managerial or professional competences that emphasise the 'freedom' to be innovative and creative, noting that through such practices, institutions will develop both competitiveness and sustainability. There is a paradox, the emphasis upon innovation and creativity which construes this as developing through individual and collective processes is set within a reductive neo-liberalism that emphasises the market and commodification and instrumentalises social relations. In this instance education is only valued for its contribution to economic competitiveness which can lead to a truncated engagement with disciplinary knowledge. This is because it is only the 'knowledge and skills' that can be directly mobilised at work that are valued, that which does not have an occupational purchase is devalued rendering it virtually 'useless'. Mulder (2014, 109) refers to the disconnection between education and the labour market that provided the spur for the development of competences. In addition, ideas surrounding the 'knowledge' economy, allied with the rapidity of technological change, meant that the development of technological and scientific knowledge in the academy was out of step with that required by 'industry' which moved at a much faster pace. Consequently innovative and creative practices, and indeed workplace learning, assumed far greater significance. It was thought this would enable quick responses to changed circumstances facilitating the development of new practices and processes. In this way a premium was placed on creativity and innovation in the workplace and the learning that surrounded this leading to the development of and increased importance attributed to mode 2 knowledge (Gibbons et al. 1994, 1–17). There are two points to be made; the first addresses autonomy. In order to be innovative and creative, the worker requires some control over the labour process. The second, by acknowledging the potential for creativity and innovation of those in nominally unskilled work, greater value and dignity is awarded to such labour with the concomitant implications for social justice. There is however a third implication that aligns the development of digital technologies with forms of social production which emphasise the creation of surplus value external to the capitalist organisation. This is captured by the notion of cognitive capitalism as well as peer-to-peer (P2P) software development and so on. In this case social production can be Janus like, amenable to capitalist colonisation as well as being a site of resistance to such relations.

9.3 Workplace Learning and Social Justice

> Really useful knowledge' was a knowledge of everyday circumstances, including a knowledge of why you were poor, why you were politically oppressed and why through the force of social circumstance, you were the kind of person you were, your character misshapen by a cruel competitive world. (Education Group 1981, 37)

> You move from one boring, dirty, monotonous job to another boring, dirty, monotonous job. And somehow you're supposed to come out of it all "enriched". But I never feel "enriched" – I just feel knackered. (Nichols and Beynon 1977, 16)

The first quotation is drawn from the work of Richard Johnson in which 'really useful knowledge' is set against 'useful knowledge'. The former anticipates the transformation of societal relations with the latter anticipating the transformation of work processes, thereby developing the productive potential of workers. The second quotation is from Nichols and Beynon's 1970s study of a chemical plant. Both passages are salutary with the first drawing upon nineteenth century discussions of education, knowledge, work and transformation. The second, drawn from the last century, reflects a moment in which there was a concern with the humanisation of work and job enrichment. It is important to recognise that the interest in workplace learning (WPL), knowledge, practice and transformation has in various guises had a long history. After all, it is pivotal to the on-going development of capitalism and capital's interest in variable labour power and value-added waged labour (see Avis 2010).

WPL is also important for workers' survival strategies in oppressive workplaces, as well as in the development of resistance to exploitative conditions, with such practices frequently involving collective processes. However, the contemporary interest in WPL derives from at least two currents. Firstly, there is the realisation that in societies such as Britain the majority of the workforce in 2020 will have already left full-time education. Felstead et al. write,

> The fact that 70 per cent of the UK workforce of 2020 are already in work has increased its [WPL] saliency still further, since most are beyond the reach of schools and may be out of reach of further and higher education. (2009, 3)

Allied to this is a second current whereby the increasing speed of change means that a premium is placed on WPL, aligning it with the rhetoric of the knowledge society. In other words we will all be enjoined to learn at the workplace with such changes informing the way in which WPL is conceived.

Analyses of WPL often assume an optimistic hue, with writers such as Billett (2005) arguing that the acknowledgement and credentialing of WPL serves the interests of social justice through its recognition of worker skills and knowledge that are frequently overlooked and remain outside the qualification system (and see Boud and Symes 2000, 18). There is something of a moral imperative in Billett's concern to value waged labour that others may construe as demeaning. Consequently lesser emphasis is placed on the negative aspects of WPL. However, for writers concerned with WPL, these arguments sit alongside issues of equal opportunity and access to educational credentials. Billett links the idea of 'just arrangements' with the recognition of the skills disadvantaged workers have developed in the course of their working life. He writes,

> Finding means to legitimately and authoritatively recognise skills acquired through work hold the prospect of providing *just arrangements* for these otherwise disadvantaged workers as well as those requiring recognition throughout their working life. [*emphasis added*] (Billett 2005, 944)

However, there does seem to be a difficulty with Billett's position. At best he seeks to accord some dignity to those who labour in low-paid and undervalued jobs.

However, this does little to challenge the social relations of work, its neo-liberal context or indeed current conditions of austerity.

This is not to deny the salience of WPL for capitalist enterprises for without this, these could barely function. Nor is this to deny the very real skills disadvantaged workers develop at the workplace, thus acquiring 'useful knowledge'. To the extent that these concerns address social justice, they do so through credentialism, by according dignity to workers whose labour has been devalued, and through the recognition that even in the case of unskilled jobs, there will be some space for innovatory and creative practices. It is however important to recognise that in industrial capitalism, variable labour power created the surplus value that capitalists appropriate – in other words capital appropriates the cognitive/intellectual abilities of workers. Gramsci suggests, "All men are intellectuals… but not all men have in society the function of intellectuals" (1971, 9). The research on WPL that seeks to validate, dignify and acknowledge the labour of disadvantaged workers illustrates the way in which cognitive capabilities are marshalled in the creation of value (see for example, Fuller and Unwin 2003; Fuller et al. 2009a, b).

The preceding has focused on the debate surrounding supposedly low-skilled jobs and workplace learning and has not engaged in a broader discussion of professional competence. There are two reasons for doing so. Firstly, technicist models of competence, whilst being able to specify the features of a particular task and the requisite outcomes, are necessarily limited. They tend to ignore the knowledge and skills workers develop through their labour – in other words the contribution of variable labour power. Secondly, professional work is often viewed as the site in which creative and innovative solutions can be developed. Such a stance is embraced in holistic models of competence that acknowledges individual and collective forms of working that can develop innovative solutions to the problems encountered. In this case the social justice implications are accented differently to that found in unskilled labour. A Deweyan understanding of professional competence aligns not only with occupational autonomy but also with citizenship and participation in a democratic society. Such an understanding of competence comes close to Lacey's discussion of collective intelligence.

> Skills and talents are concerned with solving problems within already existing paradigms and systems of knowledge. Intelligence has to do with understanding the relationship between complex systems and making judgements about when it is appropriate to work within existing paradigms and when it is appropriate to create new courses of action or avenues of thought.... *Collective intelligence* [is] defined as a measure of our ability to face up to problems that confront us collectively and to develop collective solutions. [*emphasis added*] (Lacey 1988, 93–94)

However, in a context of austerity, audit and performativity in which professional and managerial labour is being reshaped, work has become all pervasive, raising questions about the progressive features of such work. In Marazzi's terms, "one's entire life is put to work" (2011, 113) with the division between work and nonwork becoming increasingly blurred. The development of collective intelligence allied to rather more expansive models of competence is readily amenable to capitalist appropriation. The question is whether the notion of competence has become

inextricably wedded to capitalist interests, whereby the progressive portrayal of such features may be blunted whilst simultaneously serving ideological purposes. The point is that these practices are messy and contradictory.

There is a paradox in the suggestion that our 'entire life is put to work', for at the same time, as we marshal our abilities in waged labour, Cederström and Fleming suggest that:

> Self-exploitation has become a defining motif of working today. Indeed the reason why so little is invested by large companies into training is because they have realized that workers *train themselves*, both on the job, using their life skills and social intelligence, and away from the job, on their own time. (2012, 8)

Under cognitive capitalism, 'free' labour is seen as increasingly important in the creation of value, and for this reason, it is suggested that in contrast to industrial capitalism, a new regime of accumulation has developed. This new regime is centred upon digital labour and the forms of collective and social engagement that are facilitated by digital technologies. This also raises questions about the manner in which we theorise and make sense of competence – a term that is frequently tied to waged labour.

9.4 Cognitive Capitalism

> A new political landscape has crystallized transforming the old tension between capital and labour into one between capital and life. Its manifesto is defined not by the demand for more, less or fairer work, but the end of work. (Fleming 2012, 205)

Theorisations of cognitive capitalism suggest that capitalism has entered a new stage of development. Digital technologies and the increasing emphasis placed upon knowledge illustrate this, as does the emphasis on innovation and creativity. The move from Fordism to post-Fordism and the decline of industrial capitalism in the west similarly reflect this process (see Avis (2013). It is important to acknowledge that this is not based on an empiricist argument but rather upon developments at the leading edge of the economy that represent a new social imaginary and emergent hegemonic notions of capitalist relations, or what might be described as 'trajectories of evolution' (Boutang 2011, 60). Boutang (2011, 60) points out that Marx, in his study *Capital*, did not examine the largest working population in England at that time, namely, domestic servants, but rather focused on a much smaller group of factory workers, anticipating the emergent hegemony of industrial capitalism. For Vercellone cognitive capitalism,

> refer[s] to a system of accumulation in which the productive value of professional and scientific work becomes dominant and the central stakes in the valorization of capital relate directly to the control and transformation of knowledge into fictitious goods. (2009, 119)

Or as Fumagalli (2010, 62) suggests, there are three pillars upon which cognitive capitalism is built: the role of financial markets as motors of accumulation, the generation and the diffusion of network knowledge as the main source of capitalist

valorisation that redefines the relationship between living and 'dead' labour, and finally the decomposition of the workforce leading to precariousness.

These arguments align with others addressing financialisation which suggest that the manner in which surplus value is produced has been transformed (Marazzi 2011). That is to say, the 'knowledge economy' is qualitatively different to industrial capitalism, representing a new stage of development in which surplus value is appropriated in a fundamentally different way. In some respects this reflects historical processes of primitive accumulation and the appropriation of common land in the early stages of capitalism. Industrial capitalism was orientated towards the accumulation and expansion of capital, whereas the current stage is concerned with scarcity, more akin to monopoly capitalism (Baran and Sweezy 1966; Foster and Magdoff 2009). This argument prioritises the development of knowledge viewing it as a collective and implicitly democratic accomplishment that occurs outside the direct control of capital. In contradistinction to those accounts of WPL in which learning is centred on work, cognitive capitalism emphasises the role of 'common' collectively formed knowledge developed outside the labour process which is then appropriated by capital in the pursuit of surplus value. Gorz points out that cognitive capitalism operates in a different manner to industrial capitalism in that its,

> main productive force, knowledge, is a product that is in large part, the outcome of an unpaid collective activity, of a 'self production' or 'production of subjectivity'. It is to a large extent, 'general intelligence', shared culture, living and lived practical knowledge'. (Gorz 2010, 52)

These arguments are important as they serve to problematise those understandings of competence that links these tightly to the workplace (see Svensson et al. 2009).

The following comments on two closely related responses to the conjunctural conditions are currently faced. The first concerns the neo-liberal subject, the 'dead man working' of Cederström and Fleming (2012), who discuss the manner in which work, that is to say, waged labour has permeated all aspects of our lives. This is in contrast to the Fordism of industrial capitalism which was marked by specific working times.

> What makes capitalism different today is that its influence reaches far beyond the office. Under Fordism, weekends and leisure time were still relatively untouched. Their aim was to indirectly support the world of work. Today, however, capital seeks to exploit our sociality in *all* spheres of life. When we all become 'human capital' we not only have a job, or perform a job. We *are* the job. (Cederström and Fleming 2012, p7)

As against the above, the conditions in which we are placed also carry the potential for a rather different response – the refusal of work – that is to say of waged labour. This takes us back to the Italian workerism or *Operaismo* of the 1960s and 1970s. What is important for the current discussion surrounds certain features of the analysis of capitalism found therein. In contrast to arguments that emphasise the 'human-made capital' (Rikowski 1999) and the colonisation of our subjectivities by waged labour in which we become 'the job', workerism holds out the prospect for a

rather different response. Berardi, commenting on a Fordist moment set within 1970s industrial capitalism, states:

> In the car production cycle, labor had a mass depersonalized character: it is in these sectors that the refusal of work exploded… In the 1970s the entire European car production cycle was stormed by waves of workers' fights, sabotage and absenteeism. (Beradi 2009, 28)

The second point related to the current conjuncture concerns the salience of workerist analyses that rather than viewing the development of capitalism as a consequence of accumulation strategies and the pursuit of value is understood as capital's response to class struggle. Lotringer writes, "It was Italian workers' stubborn resistance to the Fordist rationalization of work… that forced capital to make a leap into the post-Fordist era of immaterial work" (2004, 11). Without engaging with the correctness or empirical veracity of workerist accounts, they do raise salient questions. These writers, commenting on the struggle against industrial capitalism in the 1960s and 1970s, emphasised the refusal of work. Notably, at that conjuncture it was the collective solidarity of the working class that enabled this 'refusal'. However, this argument suggests that subsequent capitalist developments were a response to this and were attempts to overcome worker resistance. Such analyses point towards the development of post-Fordism and the increasing importance attached to immaterial labour and cognitive capitalism. These shifts in capitalist development could be seen as attempts to circumvent the refusal of work and undermine the solidarity of the working class. Such arguments raise questions about the way in which we understand the 'turn' to competence and in particular the interest in behavioural and social competences. They relatedly raise questions about the way in which we theorise competence – that is to say, those models that emphasise professional autonomy and creativity but which also make a link to the development of citizenship and democratic engagement in wider society and social justice. A workerist analysis suggests that this is an ideological sleight of the hand that seeks to secure the interests of capital and pacify the class, albeit that this is a site of struggle.

Some writers loosely linked to workerism discuss cognitive capitalism and how work has not only colonised our lives but the way in which the production of surplus value has increasingly shifted to the private sphere (see Lotringer and Marazzi 2007). There is some resonance with feminist theory and the significance attached to domestic labour, the salience of work therein and its relationship to the production of value (see, Federici 2012; Fortunati 1995; Weeks 2011). On a slightly different note, we could think about digital technologies and allied notions of social production and co-configuration as well as the manner in which activities occurring outside formal waged relations can create surplus value. For Engeström (2010), as with Adler and Heckscher (2006), the logic of capitalist development arising from the transformation of the forces of production is towards the incipient socialisation of the means of production. Engeström (2010, 232) draws upon Victor and Boynton (1998, 233) to illustrate the direction of change in the modes of production, from craft production to subsequent developments where we encounter conceptualisations of mass customisation, co-configuration, leading towards social production.

In the latter case, we may use Facebook to keep in touch with family and friends, but it will also generate surplus value, or if you prefer advertising revenue. In addition, through the labour involved in constantly updating our pages, we invite our contacts to revisit the site and encounter the advertising therein. At the same time, these pages may be used for networking, with all the contradictions and tensions that this generates (Coté and Pybus 2011). Allied to these processes, we encounter terms such as co-opetition, produsers, 'playbor', and Pro-Ams. Engeström refers to Benkler's (2006) work on P2P (peer-to-peer), open source and the development of software and social production. Peters writes in relation to open science that,

> Open source initiatives have facilitated the development of new models of scientific production and innovation where distributed peer-to-peer knowledge systems rival, the scope and quality of similar products produced by proprietary efforts… Proponents say these "open access" practices make scientific progress more collaborative and therefore more productive. (2013, 7)

Such practices are facilitated by digital technologies and the related networks, with "big science" drawing upon teams of scientists who are linked by global networks as well as Pro-Ams who provide free labour, often through their help in analysing "big data". In some respects these networked practices which draw on social media increasingly reflect academic labour processes as well as contributing to the colonisation of life by work. This means we need to rethink the notion of competence in a context where productive labour takes place external to the firm and 'employment relations'.

Importantly, within immaterial and cognitive capitalism, creativity, innovation and knowledge are thought to be the main sources of value. This rests alongside a number of other claims such as the marketisation and commodification of what was formerly delivered by the welfare state – education, health services and so on (Roth 2010). This expansion of marketisation derives from the crisis of profitability and the desire to expand commodity relations so as to provide additional sources of profit. More significantly there is another argument that places knowledge centre stage. This draws on Marx's (1973) discussion in the *Grundrisse* on the significance of science for the development of the forces of production allied to the formation of the collective worker. Certain features of Fordism facilitated the shift towards cognitive capitalism. For example, the development of the welfare state and universal education contributed towards a "mass intellectuality" that provides the bedrock for the knowledge economy. Vercellone (2008) refers to 'the constitution of a diffuse intellectuality generated by the development of mass education' (unnumbered) allied to increasing levels of training. In addition he argues that the social struggles that secured 'the spread of social income and welfare services' (unnumbered) resulted in conditions favourable to the development of a knowledge-based economy.

The significance of the above is that it prioritises both the development of knowledge and views this taking place outside the direct control of capital, with surplus value being appropriated in a qualitatively different manner to that found within

industrial capitalism. This process is partly captured by the notion of the biopolitics of labour whereby:

> one's entire life is put to work, when knowledges and cognitive competences of the workforce (the *general intellect* that Marx spoke about in his *Grundrisse*) assume the role played by machines in the Fordist period, incarnated in the living productive bodies of cooperation, in which language, effects, emotions and relational and communication capacities all contributed to the creation of value. (Marazzi 2011, 113)

For those who adopt this argument, the knowledge and competences of the workforce are developed collectively by living labour and importantly are external to capitalist relations. It is in this sense that capital is attempting to subsume the 'common' and explains why the labour theory of value is thought to be redundant. However, having said this it is important to acknowledge that:

> The mechanical transformation of matter by means of a twin expenditure of energy and labour power does not disappear but it loses its centrality in favour of a cooperation of brains in the production of the living by means of the living, via the new information technologies, of which the digital, the computer and the Internet are emblematic in the same way in which the coal mine, the steam engine, the loom and the railroad were emblematic of industrial capitalism. (Boutang 2011, 57)

Earlier Boutang stated that cognitive capitalism, "in no sense eliminates the world of material industrial production. Rather it rearranges it, reorganises it and alters the positioning of its nerve centres" (2011, 48). The significance of arguments that stress the centrality of living labour and the importance of social production in value creation means that increasing numbers of people are placed outside a direct relationship with capital becoming part of a surplus population. In the past we would have referred to this group as a reserve army of labour.

This brief exploration of workerism and cognitive capitalism may appear somewhat removed from a discussion of WPL and the notion of competence, but it serves to raise a number of pertinent issues, key amongst which is the relation of these to social justice. A workerist analysis suggests that competence in either a narrow or expansive version is wedded to capitalist interest being concerned with the development of variable labour power. The debates surrounding cognitive capitalism draw our attention to the way in which our lives beyond waged labour are put to work. This similarly problematises the notion of competence.

It is also important to acknowledge the critiques that have emerged in response to debates surrounding cognitive capitalism and immaterial labour. Camfield (2007), for example, has developed a swingeing critique of Hardt and Negri's concept of immaterial labour suggesting the term is so broad as to be all encompassing and incoherent (and see Hardt and Negri 2000, 2004, 2009). The emphasis on the mobilisation of living labour in the generation of surplus value external to capitalist relations has also been critiqued. Rikowski's (1999) conceptualisation of the 'human-made capital' is pertinent here. He suggests that we introject the contradictions of work that exist within capitalism and become complicit in our own exploitation. Additionally the redundancy of the labour theory of value can also be questioned if we consider the intensification of labour. Rather than seeing a rupture between

capitalist labour processes and the rest of life, we could point to a continuity whereby work becomes all encompassing (Caffentzis 2011). There are those who draw attention to the crisis surrounding the overaccumulation of capital and the manner in which it constantly seeks to secure new forms of valorisation (Harvey 2010).

Perhaps we should re-evaluate arguments addressing the refusal of waged labour and those that suggest that as a result of a diffuse intellectuality, we are contributing towards the development of value external to the capitalist enterprise. Earlier Cederström and Fleming were cited who suggest that, "Self-exploitation has become a defining motif of working today" (2012, 8). They go on to argue, "meaningful workplace politics ought not to be calling for fairer work, better work, more or less work, but *an end to work"* (2012, 8), or as Berardi suggests:

> In reality technological development tends to make manual labor useless and its evaluation in terms of wages impossible. But since the relational context where this message and this process is inserted is that of capitalism, which is founded on wage-earning regulations, a double bind starts functioning. (Berardi 2009, 66)

If such an argument were accepted, it would undermine those authors who in a conventional sense celebrate waged labour, seeking to dignify and accord its value. It could be suggested that such work becomes a means of disciplining labour and serves as a prop for capitalism. Glaser (2014), in discussing Graeber's (2013) work, argues that 'bullshit jobs', or what might alternatively be described as 'busy work', tie us to capitalist relations. This may derive from the value we accord to waged labour but also from the fact that "a population that is busy and tired is less likely to revolt" (Glaser 2014, 83). These arguments suggest that much productive or what we might view as worthwhile or really useful labour arises external to capitalist relations. If much waged labour is merely 'busy work' with 'technological development tend[ing] to make manual labour useless' (2009, 66) and if as a result of our collective endeavours we create surplus value external to the capitalist organisation, we encounter an argument justifying a guaranteed social income. This is because our activities external to waged labour create value (Boutang 2011, 160; Gorz 2010). Paradoxically this would open up the possibility of 'really useful work' that extends beyond the confines of neo-liberalism and capitalist relations. Perhaps this could cohere with and go beyond Dewey's construction of competence, thereby facilitating the development of citizenship and democratic participation in a wider society committed to social justice.

The provision of a guaranteed social income raises a number of issues, one of which concerns the role and autonomy of the national state within the current stage of capitalist development. A sustainable guaranteed social income is predicated on the state being able to deliver this, thereby reintroducing a type of social democracy. It is important to acknowledge that post-war social democracy and the development of the social state have won as the result of struggle set within very particular conditions which may not be replicable. The post-war social state arose as a consequence of the shifting balance of power between labour and capital, in favour of the former, with the subsequent move towards neo-liberalism representing the reappropriation of power by capital. If accepted, this argument suggests that inclusive or progressive

varieties of capital may only temporarily ameliorate the excesses of capitalism – that is unless they presage a fundamental transformation of socio-economic and political relations. This is because such change is the outcome of struggle and alterations in the balance of power between capital and labour and therefore will be temporary, despite assertions to the contrary. We need only consider the recent history of the social state – after all, Fordism was set in exceptional circumstances. A guaranteed social income would necessitate transcending capitalist relations, and in current conditions, this would be at best a form of revolutionary reformism, prefiguring a fundamental transformation of economic relations.

Despite the growth of insecurity, the precariousness of waged labour, the collapse of collective bases of solidarity and increased individualisation, the material conditions facing many workers, whether defined as working or middle class, hold out the possibility of forms of solidarity arising from precariousness. Thus, for members of the precariat, forms of solidarity may also derive from practices surrounding social and cooperative production arising outside the workplace (see Peters (2013, 205–210); Standing (2011)). Such a position would need to challenge the domestication of creativity, innovation and social production by interrogating these for their political implications. It is easy enough to celebrate empowering possibilities particularly when these can be presented as radical despite being amenable to capitalist co-optation. Arguments addressing WPL can readily provide a radical backdrop for analyses that discuss the learning, creativity, innovation and generation of knowledge outside and within the workplace. Yet such analyses can so easily become tied to no more than the development of labour power, that is to say, the skills and capacities of the workforce which serve capitalist purposes. Such analyses at best offer a critique of neo-liberalism and its concerns with marketisation, consumerism and privatisation, calling for its replacement with a variant of social democracy. However, such a politics is doomed to failure. Whilst it might offer some amelioration of the harsher elements of current conditions, it would still be wedded to capitalism with all the tensions and contradictions entailed. It is salutary to recall the words of Ralph Miliband.

> Social-democratic parties, or rather social-democratic leaders, have long ceased to suggest to anyone but their most credulous followers (and the more stupid among their opponents) that they were concerned in any sense whatever with the business of bringing about a socialist society. (Miliband 1973, 244)

Whilst this argument distances us from a discussion of competence, it serves to raise questions about the way in which we make sense of the term in these new conditions. It also raises questions about the manner in which we understand knowledge and knowledge-based economies (KBEs). There appears to be a tension between the discourse of cognitive capitalism and the relationship of waged labour in KBEs to knowledge. Whilst both discourses centre knowledge, the work of Brown et al. (2011) suggests that the notion of knowledge work has become overblown in KBEs, drawing our attention to the standardisation of this work as in

digital Taylorism. In addition such processes sit alongside the salience of 'busy work' and precarious labour. The importance of knowledge work in cognitive capitalism points towards the mobilisation of social networks in the development of knowledge external to the firm which also aligns with aspects of the academic labour process. These processes work in tandem, but for many workers, the promise of KBEs is very far from their lived experience of work, even though their waged labour will draw upon cognitive capacities; this will be at some distance from the ideological representation of knowledge work in KBEs. The mobilisation of cognitive skills can be seen in Beckett and Hagger's (2002, 48–54) study of carers working with those suffering from dementia. It can also be seen in Fuller et al.'s study of van drivers (2009a, 749) and indeed Billett's (2008) study of hairdressers. These would all be cases in point with such labour being very different from the rhetorical representation of knowledge work in KBEs. Keep and James capture the tenor of these representations when they write,

> [A] 'knowledge-driven economy' that would usher in an era of unbridled creativity where a workforce of knowledge workers, would command 'authorship' over their own work routines and activities, would be created. (Keep and James 2012, 211)

9.5 Vocationalism, Vocational Pedagogy, Competence and Knowledge

Some versions of competence align this not only with the development of workplace knowledge and skill but also with the acquisition of appropriate dispositions, that is to say, behavioural/social competences. In the latter case, these softer skills can be linked to team building, problem-solving and so on. The acquisition and engagement with knowledge can be linked to the underpinning disciplinary knowledge that informs occupational practice. However, this can be construed as a broader process linked to the development of citizenship as well as a democratic engagement with wider society. The German system of VET and apprentice training has frequently been portrayed in this light – as being able to develop workplace skill and knowledge alongside citizenship that encourages democratic participation in wider society (see Coffield 2014, 4). It is important to acknowledge the neo-liberal socio-economic context in which this is set as well as the manner in which the German system is responding to change. Müller's (2014) analysis of school-based processes has a resonance with Thelen and Busemeyer's (2011) discussion of VET and apprenticeship. Müller (2014) expresses concern over the direction of the German school system that he fears is becoming more focused on competence and learning outcomes. He is concerned that these developments are wedded to a restricted focus on competitiveness that serves to narrow schooling so that it addresses the needs of the economy. Müller suggests that in German policy and schooling debates, competence carries with it three core meanings: an 'output orientation', 'the concept of

predictability and governance' and 'the possibility of empirical evaluation and examination' (92). For him such processes lead to an antieducative experience whereby:

> What is aspired to is the training of skills and the transfer of stored knowledge, which are believed to be conducive to the preservation and expansion of individual and common prosperity as well as the prosperity of German business in a globalized world. (2014, 93)

In a not dissimilar vein, Thelen and Busemeyer (2011) point to what they refer to as the shift from collectivism to segmentalism in German VET. In the former, employers were encouraged to overtrain, thereby producing workers with broad and portable occupational skills, whereas in the latter, training is organised around internal labour markets and the specific needs of the companies concerned (Thelen and Busemeyer 2011, 69). As with Müller, this leads to a truncated experience for trainees. Such processes are exacerbated by the development of a state sponsored 'transition system' designed to meet the demand for training amongst 'academically weak' youth. This fails to address the shortfall in apprenticeships or to provide the disciplinary engagement that formerly characterised German VET (Thelen and Busemeyer 2011, 90). Niemeyer's (2010) case study exploring the reframing of pre-vocational education in Germany illustrates this process where there is a focus on young people's attitude to waged labour. It is important to acknowledge that Germany, as with other European states, is set within a global economic system in which neo-liberalism is hegemonic. Brown et al. (2011) draw our attention to the logic of neo-liberalism – the necessity to reduce cost in order to remain competitive as well as the global sourcing of labour (124).

The notion of competence, vocationalism and vocational pedagogy cannot be thought of outside their specific institutional and national contexts. At the same time, these notions are subject to temporal change shaped by the different economic circumstances facing national states. A straightforward understanding of vocational education/pedagogy would simply refer to learning for work and developing the skills required to labour effectively. Notably, this is a peculiarly Anglo-Saxon conceptualisation of vocational education and pedagogy with Brockmann et al. (2011) suggesting that VET is thought of quite differently in other social formations. Yet at the same time, there are 'global' processes linked with neo-liberalism that encourage its technicisation and instrumentalism. For Wheelahan (2010) and other writers (Young 2006, 2009; Beck and Young 2005; Muller 2012; Rata 2012) who adopt a social realist understanding of the curriculum, such processes undermine the salience and indeed value of vocational education and training. For these writers VET, at its best, offers young people access to powerful knowledge, epistemic gains not readily accessible in other forms of knowledge. Through VET young people will have access to disciplinary knowledge and consequently will be able to participate in societal conversations – this being an aspect of distributive justice (see Avis 2014). If young people encounter a truncated VET which is fragmented and instrumentalised so that it directly addresses the needs of capital, the potential of VET will be missed. At best VET and its pedagogy are much more than simply about work and in this instance will have to move well beyond instrumentalised conceptu-

alisation of competence. In this way VET will be able to address the changing features of capitalism and enable learners to think beyond current conditions, address social justice and embody a politics of hope.

9.6 Conclusions

Maybe we should rethink and move beyond the notion of competence, whilst resuscitating its progressive elements. It could be argued that competence has always been concerned with more than waged labour, yet at the same time, it is a site of struggle, but one easily colonised by capital. Some writers suggest that the early development of the term was a response to the perceived failings of schooling and the irrelevance of much education to the requirements of waged labour. It is however important to acknowledge that the notions of competence and education are multifaceted and carry with them a range of contradictory meanings. Perhaps following workerist analyses, we could view the 'turn' to competence as a strategy to pacify the working class and as capital's response to worker resistance to Fordism.

In some respects the arguments surrounding cognitive capitalism and Italian workerism can lead to a somewhat rarefied discussion rooted in various forms of neo-Marxism. These could represent an intellectual cul-de-sac, distanced from the lived experience of working and labouring in contemporary capitalism. These terms carry with them a diverse range of analyses accented in different ways which result in a degree of inconsistency. Yet the arguments that have been marshalled concerned with these approaches are significant in that they raise a number of important questions. For some writers' social production, co-configuration, mass customisation and the use of the internet to develop open source software and so on carry progressive and democratic possibilities (Benkler 2006; Guile 2010; Engeström 2010). Theories of cognitive capitalism provide a corrective, illustrating the way in which capital seeks to appropriate and valorise such practices. Discussions of cognitive capitalism illustrate both the dynamism and the way in which capitalism constantly seeks to transform social relations. Despite the difficulties surrounding the notion of the 'refusal' of work, it nevertheless raises questions about the nature of work in capitalist societies as well as pointing towards different ways of organising social and political life. Importantly, the argument that much manual labour is unnecessary highlights contradictions surrounding the development of the forces of production, whereby existing social relations inhibit the full development of society. Whilst these analyses may be limited, they serve to problematise approaches to WPL that seek to align this with a progressive politics tied to social justice commitments. For those of us who echo Cederström and Fleming's (2012) description of "dead man working", such analyses point towards the exaggerated significance attached to waged labour. For these reasons workerist analyses make an important contribution to discussions of WPL and VET and force us to think beyond productivist conceptualisations of competence.

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Chapter 10
The Integrated View on Competence

Paul Hager

10.1 Introduction

This chapter begins with an outline of the main features of an integrated understanding of competence and how this understanding differs from some other common approaches to competence. This is followed by a detailed consideration of an *integrated* understanding of competence. Beginning with a discussion of the basic logic of the concept of competence, the underpinning principles of the integrated approach are elaborated, as well as its applications in a variety of occupations and for a diversity of purposes and its advantages and limitations. This discussion serves to further distinguish an integrated understanding from rival approaches to competence. Finally, it is argued that the integrated approach accords very well with recent theoretical developments in related topic areas, such as the nature of skills, practice theory and complexity theory.

10.2 How an Integrated Understanding of Competence Differs from Rival Understandings

Behaviourism is a theory of learning whose explanatory focus is overt behaviour and the conditions for shaping it, whilst avoiding any reference to putative 'inner' entities, such as mental states (see, e.g. the chapter of Barrick in this volume, as well as Kalantzis and Cope 2009; Phillips and Soltis 2009). A widely held, but simplistic, view is that *training* is a form of learning centred on development of motor skills with

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minimal cognitive demands (see, e.g. Winch 1998, 2010). Not surprisingly, these two familiar ideas have coalesced to shape how competence has been thought of in relation to the trades and other occupations with a significant manual component. Competency-based training (CBT), as commonly understood, views competence as a series of specific tasks or the behaviours involved in the completion of these tasks (see, e.g. Arguelles and Gonczi 2000). To many, this approach appears to reflect 'common sense'. Since competency-based assessment tests performance, and since performance is commonly thought to be the completion of a series of tasks, it seems obvious that competency standards should be a series of discrete task descriptions.

However, major limitations of this approach to competence soon become evident. It quickly becomes too atomistic. More and more minute work tasks can be specified, yet being 'ticked off' against each of a myriad of tasks does not always equate to workplace competence. Competent performance involves much more than the mere sum of numerous minute task behaviours. What this 'sum of the tasks' approach overlooks is that competent performance requires a further capacity to put all the parts together to produce an appropriate response to the given particular circumstances. Even for work that is relatively routine, this 'checklist' approach is defective as important broader aspects of competent performance, such as planning or reacting to contingencies, are overlooked.

Nor should 'tasks' be understood in an exclusively narrow sense. All occupations involve performance of various relatively specific tasks. But more importantly, virtually all of them involve performance of broader, more generic tasks such as planning, contingency management, organising, etc. At their broadest, tasks can include such notions as performing in accordance with an overall conception of what one's work is about or working ethically. So, the task view of competence typically omits 'higher-level' competencies from the competency standards. The result is their absence from training programmes and assessment strategies based on these narrow competency standards.

Yet this 'sum of the tasks' approach to competence has been widely influential in the implementation of CBT internationally. Seemingly, this flawed view of competence accords with widely held 'common sense' intuitions (for detailed discussion, see Hager 2004). It is also the approach to competence that has captured the almost exclusive attention of well-known critics, such as Hyland (e.g. 1994, 2014). The fact that richer understandings of competence are available is too often ignored.

A very different view of competence has been influential in management and business circles. Here competence is conceptualised as proficient and effective deployment of a series of generic attributes or skills, such as problem solving, pattern recognition, organising, planning, gathering and analysing data, communicating, etc. On this view, 'generic attributes' can also include appropriate knowledge and desirable attitudes and values. A well-known example of this approach is job competence analysis (Boyatzis 1982). According to this generic approach, training and assessment will consist of strategies to train and assess candidates in each of the relevant generic attributes.

Though this generic approach to competence looks more likely to encompass the less predictable aspects of nonroutine work roles, it turns out that assessing attributes in isolation from actual work practice is a poor predictor of future occupa-

tional performance (Hager and Smith 2004). Rather it seems that attributes such as problem solving, analysis, pattern recognition, etc. are highly context dependent, so much so that efforts to teach and assess them out of context are largely ineffective. So training and/or assessing novices in generic attributes such as problem-solving or communication skills raises the difficulty of how, if at all, practitioners will be able to transfer this learning to their future work contexts.

So, a major limitation of this approach is that it downplays contextual factors. Is (say) communicating really generic across contexts or does it require somewhat different skills in widely differing contexts? As well, a list of generic attributes or skills is actually a very thin representation of occupational competence. This becomes apparent when we realise that very diverse occupations feature very similar sets of generic attributes or skills. So this generic view of competence tends to omit those very features and activities that constitute an occupation's distinctive or unique character.

The limitations of these two approaches to competence led to a different approach, involving an integrated conception of competence, being employed by the Australian professions in establishing their competency standards in the 1990s. (An integrated conception of competence was also adopted elsewhere, e.g. see Mulder (2014) and Mulder et al. (2007).) According to the integrated approach, competence is understood in terms of knowledge, abilities, skills and attitudes displayed in the context of a carefully chosen set of realistic professional tasks which are of an appropriate level of generality (Gonczi et al. 1990; Hager 1994). Thus, the integrated understanding of competence gives prominent attention to both key occupational tasks and to the various attributes that practitioners need for competent performance of these key tasks. Typically, about 20–30 key (or major) occupational tasks are identified and the various practitioner attributes that they imply are elucidated. This information becomes the basis for constructing an initial set of competency standards.

A distinguishing feature of the integrated understanding of competence right from its initial formulation (Gonczi et al. 1990) was its commitment to a significant degree of holism in its description of professional practice. This arose from the substantial experience of professional practice, in its widest sense, gained by Gonczi and Hager as they tutored and supervised novice vocational education and training (VET) teachers in the theory and practice of teaching. Typically, these 'novice' teachers were mature, widely acknowledged experts in their particular occupation. Usually, the major reason for their appointment as VET teachers was the wide recognition by their peers of their high levels of skilled performance in their particular occupation. This meant that Gonczi and Hager had direct contact with highly skilled performance in many and diverse occupations, not just in classrooms but, more tellingly, in workshops, studios, laboratories and the like. The wide range of occupations that they had encountered encompassed the various sciences: the applied sciences, such as dental mechanics, opticians and pathology technicians; engineering of all kinds; vehicle repair and maintenance; carpentry, wood machining and cabinet making; and the arts, such as painting, sculpture and jewellery. Repeatedly they were struck by the high levels of skills exhibited by these novice teachers and their enthusiasm for and commitment to passing them on to others. But what left the

biggest impression was the evident *seamless know-how* that was the hallmark of their highly skilled performances. At every turn they seemed to encounter this seamless holism of professional practice in its broadest sense. Although Gonczi and Hager were well aware of the relevant literature on skilled performance and expertise, over time they concluded that received theories and concepts did not adequately account for the richness and diversity of the holistic skilled performances that they witnessed regularly (for a more detailed account of this, see Hager 2013). Thus, in 1990, when the concept of competence started to claim wide attention, they were interested in its possibilities for capturing something of the holistic, seamless expertise that they had experienced and that seemed to elude received theories.

The integrated view of competence puts major emphasis on the contextuality of workplace performance. On this view, competence can be summarised as *contextualised capability involving an integration of assorted practitioner attributes*. These attributes include such things as cognitive skills (knowledge, critical thinking, problem-solving strategies), interpersonal skills, affective attributes and technical/psychomotor skills. Using this approach, an occupation can be represented as a set of competency standards in which key occupational tasks are integrated with the attributes required for their performance. Another crucial aspect of the integrated view is its emphasis on the vital necessity of the competency standards being used *holistically*. This entails, amongst other things, that it is very likely that any segment of actual workplace practice will simultaneously involve more than just one of the key occupational tasks. An important corollary of this is that, for maximum validity, competency-based assessment activities need to focus on strategically selected slices of actual workplace practice, rather than on the key occupational tasks taken one by one in isolation. These issues will be treated more fully in a later section that considers in detail the integrated view of competence, including its limitations.

By focussing on the key tasks (or elements) that are central to the practice of the occupation, the integrated approach to competence avoids the problem of atomisation into a myriad of tasks. By seeking to elucidate the bundles of major practitioner attributes that are involved in the competent performance of key occupational tasks or elements, the integrated approach to competence avoids the problem of treating attributes generically in isolation from their contexts of use. It is noteworthy that the integrated approach to competence also overcomes the various difficulties posed by Ashworth and Saxton (1990) in their useful catalogue of the limitations of narrow competency standards (for discussion of this, see Hager and Gonczi 1991). The integrated approach to competence has now been employed successfully in Australia and elsewhere by a range of professions and other occupations for 25 years. Experience has shown that these integrated competency standards can capture the holistic richness of occupational practice in a way that neither of the other two approaches could. Amongst various uses, these holistic competency standards have served to facilitate the design of effective professional development and assessment frameworks. Detailed accounts of the employment of integrated competency standards in Australia include Ash et al. (1992), Gonczi (1994), Hager and Gonczi (1998), Hager (2000), Stone et al. (2011) and Gonczi (2013).

As this section has demonstrated, there are various ways of conceptualising competence. Each approach will have its own distinctive advantages and limitations. Particularly if competence is viewed too narrowly, possible benefits to be gained from adopting competency standards may be severely curtailed. Further significant benefits of adopting broader, richer understandings of competence will become apparent as this chapter proceeds. The next section will aim to clarify the nature of competence. It turns out that the logic of the concept of competence supports broader views of competency standards, rather than the narrower ones that are often seen as the obvious choice.

10.3 What Is Competence?

Since there are several very different ways of thinking about competence, how competence is conceived will make a big difference to the ways in which competency standards are used and assessed. However, a careful consideration of the *logic* of the concept of competence supports a relational understanding of competence, as exemplified in the integrated approach. As discussed elsewhere in this volume (Chap. 1), dictionary definitions of competence centre on competent people having the ability (or capability) that will enable the satisfactory completion of some task(s). When the abilities or capabilities required for competent performance of an occupation are elucidated, the descriptions typically employ terms such as 'knowledge', 'skills' and 'attitudes', i.e. personal attributes or characteristics of practitioners that enable and enhance competent performance.

Dictionary definitions (see Chap. 1) also emphasise that ability or capability is the major focus of the concept of competence. In turn this draws attention to the attributes that comprise these abilities or capabilities. It follows that attributes are a logically necessary part of any satisfactory understanding of competence. It would seem that any plausible set of occupational competency standards needs to feature some specification of the abilities or capabilities required for competent performance of the occupation.

But attributes are not, by themselves, sufficient, as dictionary definitions also stress, abilities or capabilities, which are directed at a particular task or tasks. Thus, competence is never an ability or capability in the abstract – it is always in relation to appropriate object(s). As we have seen, the concept of competence carries with it the notion of the abilities or capabilities being applied to the performance of some tasks. So, any satisfactory understanding of competence must include both attributes and tasks, as must any plausible set of occupational competency standards.

This conclusion can be summarised by stating that the concept of competence is inherently relational, i.e. it necessarily links two disparate kinds of things. Essentially competence is a relation between abilities or capabilities of practitioners and the accomplishment of appropriate task(s). So the logic of the concept of competence supports an integrated approach to competency standards. Approaches that focus exclusively on either tasks or attributes miss the essential relational character of

competence, thereby impoverishing the concept and its usefulness. Only when the essentially relational nature of the concept of competence is recognised will something approaching the holistic richness of occupations be captured in competency standards.

Another very important consequence of the logic of the concept is that competence itself is necessarily inferred from performance, rather than being directly observed. It is performance of tasks that is directly observable. However, the abilities or capabilities that underlie the performance are not directly observable. Rather we infer their presence or otherwise on the basis of performance evidence. The upshot is that assessment of competence relies inevitably on *inference* based on a sample of performance. Of course, this sample will need to conform to criteria that ensure validity and reliability. In this respect, assessment of competence is no different from other kinds of assessment.

10.4 Further Elaboration of the Integrated Understanding of Competence and Its Applications

Competency standards provide a representation of what is involved in the proficient practice of an occupation. They essentially do two things: firstly, they describe the main activities ('tasks') that comprise the practice of the occupation and, secondly, they set out the standards that characterise competent performance of these activities. It is this second component that typically encompasses practitioner attributes. Clearly, a degree of analysis is implied in setting out the main activities that comprise the practice of the occupation and in identifying the attributes involved. Some have labelled this move as 'atomistic' in a pejorative sense. However, developing an understanding of complex matters requires some analysis. Such analysis is only strictly atomistic if it is not counterbalanced by appropriate synthesis. For instance, the analysis of an occupation into a myriad of tasks, as with the task approach to competence, is overly atomistic precisely because actual practice is much richer than mere sums of isolated tasks. This approach fails because of its one-way atomism. It offers no account of how the atoms are 'put together' (synthesised) to produce a performance suited to the particular context. However, the integrated understanding of competence involves both analysis and synthesis working in tandem. This approach's limited degree of atomism is more than balanced by its characteristic holism.

10.4.1 The Holism of Integrated Competency Standards

Occupational competency standards produced by an integrated approach are *holistic* in a multiplicity of crucial senses:

The first holistic aspect of integrated competency standards derives from the fact that the 20–30 key tasks are not discrete and independent. They are 'molecular' rather than 'atomic'. This means that actual work practice, and, hence, the sound assessment of it, will normally encompass simultaneously several of the key tasks.

A second way that integrated competency standards are holistic is that the key tasks involve the practitioner employing 'situational understanding', i.e. the competency standards include the idea of the practitioner adapting practice to take account of the varying contexts in which they are operating. So the practitioner needs to employ a more general cognitive perspective to frame a skilled response appropriate to the particular contextual circumstances.

A third way in which integrated competency standards are holistic has already been mentioned. It is that competence is a construct that is not of itself directly observable. Rather, it is inferred from observations of performance on a suitable set of relatively complex and demanding tasks. The relative complexity of the tasks can be gauged from the fact that a typical occupation involves no more than 20–30 such key tasks. What this means for assessment is that rather than assessing the key tasks (elements) of the competency standards one by one in isolation, various slices of actual practice are used to provide data on which to judge competence. So assessment is holistic in that, instead of assessing a key task in a single assessment event, data drawn from various assessment events come together to testify to competence or otherwise in relation to that key task.

By being holistic in the above several senses, integrated or relational competency standards are the opposite of any significantly atomistic approach, whether the atoms be tasks or attributes. Thus, integrated competency standards avoid the misguided extremes of fragmenting the occupation to such a degree that its character is destroyed by the analysis or adhering to a rigid, monistic holism that rules out all analysis.

10.4.2 Holism and Professional Judgement

All of the above three aspects of holism highlight the central role of *professional judgement*. The first kind of holism stresses that actual work practice typically involves two or more of the key tasks simultaneously. Thus, competence involves more than the mere capacity to perform the key tasks separately one by one. This something more is a capacity for 'putting it all together' seamlessly in a performance that subsumes several key tasks at once. Accomplishing this well requires sound professional judgement on the part of the practitioner. Likewise, valid and reliable assessment of such performances requires assessors who are themselves competent to carry out the practice that they are assessing. This requirement that assessors be properly qualified and experienced, that is, that they possess professional judgement in the practice that they are assessing, seems obvious and uncontroversial on the integrated understanding of competence. However, it is noteworthy that adherents of some narrower views of competence, such as ones that reduce

occupations to checklists of discrete tasks, have often assumed that minimal assessor involvement with the practice of the occupation is sufficient for them to observe performances of tasks and to tick them off against a checklist. In effect, such arrangements deny the role of professional judgement either in the practice of the occupation or in the assessment of it.

The second kind of holism exhibited by integrated competency standards is that proficient performance requires the practitioner to employ 'situational understanding', i.e. the practitioner adapts their practice in the light of varying contextual factors. This means that guidelines to practice, such as protocols, rules and norms, need to be interpreted in accordance with the particularities of a given situation. This adapting and interpreting requires the practitioner to exercise well-developed professional judgement. Such judgement is developed and refined by ongoing experience of successful practice, as, e.g. the Dreyfus (2001) seven stage model of expertise development illustrates. (In this model, competence is the third stage.)

The third sense in which integrated competency standards are holistic is, of course, the crucial one that competence is a construct that is not directly observable. Rather, competence is always inferred on the basis of what *is* observable, i.e. performance. Thus, professional judgements underpin decisions about the types and quantity of performance evidence needed to justify judgements of competence, hence the need for properly qualified assessors as stressed above. Clearly then, there are very strong links between the holism of integrated competency standards and the exercise of informed professional judgement (for more on these matters, see Beckett and Hager 2000; Lum 2013).

10.4.3 The Diversity of Professional Judgement in Practice

Many and varied instances of applications of professional judgement can be found readily within the practices of a wide range of occupations, not just in the traditional professions. This rather ubiquitous fact suggests that competency standards that lack the holistic dimensions of the integrated approach are thereby deficient. Firstly, let us consider some instances of the professional judgement of practitioners needing to be contextualised. Ambulance officers often attend motor vehicle crashes, some of which are quite horrific. They are responsible for extracting injured passengers from the wrecked vehicles and for providing initial treatment of their injuries. Ambulance officers employ protocols and guidelines for removing injured passengers from wrecked vehicles so as to minimise the chance of further injury. But the bewildering multiplicity of ways and degrees in which vehicles can be wrecked and occupants trapped means that ambulance officers frequently need to interpret the protocols and guidelines in terms of the specific context. In fact, initial disagreement about the best way to proceed is not uncommon. No matter how well the guidelines and protocols are specified, in practice ambulance officers often need to employ professional judgement to decide the best course of action in the given circumstances (for more, see Hager and Halliday 2006: 175). Similar considerations

apply to the practice of child support case managers (adapted from Hager and Halliday 2006: 175–6, 228–9). The procedures to be followed for the various types of cases are highly standardised. However, a difficulty with these standardised procedures is that many cases have their own distinctive features that mean that they resist easy classification. There is a danger that too rigid a commitment to fitting all cases into the procedures and protocols will mitigate against the main business aim of achieving quality outcomes for clients. In effect, the quality assurance system can, in some instances, work against the achievement of quality outcomes. To counter this, managers are encouraged to exercise professional judgement so that cases are thought through in terms of the spirit of the legislation, rather than by strict adherence to procedures that are followed for their own sake. In short, child custody staff need to develop professional judgement about when and how to break the rules. The moral here is that though performance as outcomes can be specified minutely, if these performance descriptors are applied too rigidly as guides for action, they can encourage suboptimal practice.

Examples of practitioners needing to move away from over-reliance on formulaic protocols can be found in diverse other occupations. For instance, novice doctors are given a stepwise protocol for achieving diagnoses. As these doctors gain clinical experience they fairly quickly rely less and less on the protocol, whilst increasingly making reliable diagnoses (Shulman 2004: 253–6). Likewise, novice teachers use well-tried lesson plan guides to prepare their classroom teaching activities. Once they gain some classroom experience, their need for these guides quickly diminishes.

These examples illustrate Dreyfus' point that good practice requires practitioners to go beyond strict adherence to the rules of practice. Whilst performance as outcomes can be specified closely, performance descriptors that are taken too literally as guides for action can interfere with good practice, as the Dreyfus (2001) model of expertise development suggests (for more on this, see also Winch 2010: 81ff. and 2014).

Next we consider some examples that illustrate aspects of the holism that characterises practitioner deployment of 'situational understanding'. An important aspect of many occupations is the capacity to interact effectively with others. Although various norms and tips can be provided on how to do this well in specific contexts, individual differences in people's makeup seems to require that each practitioner needs to develop and cultivate their own personal style for interacting effectively with others. For instance, teachers need to develop their own personal style of classroom management (Wubbels et al. 2012). Novice teachers are tempted to mimic the classroom management approaches of their own inspirational teachers or mentors (see Hager and Halliday 2006: 230). This can be useful up to a point, but ultimately it appears that each teacher needs to develop their own particular style, one that suits their own personality. This involves contextualised professional judgement, much of which is tacit. Here a major part of the context is oneself – who you are and how you interact with others.

Again, this accords with Dreyfus' (2001) seven stage model of expertise development. He agrees that practitioners can develop towards expertise by learning style

and other tacit aspects of practice from influential masters. But he warns that following a master too rigidly can become stultifying. To attain mastery, practitioners need to develop their own unique style and ways of practice. Similar considerations apply to practitioners in the medical and health fields as they seek to develop a personal capacity for interacting effectively not only with patients and clients (e.g. see Hager and Halliday 2006: 230) but also colleagues, particularly senior colleagues (see Hager and Halliday 2006: 152–3).

The above are instances where practitioners' situational understanding of their work involves awareness of themselves and their own strengths and weaknesses. This understanding underpins the exercise of complex professional judgement, much of it tacit, on how best to proceed in particular situations. Another type of situated professional judgement involving self-awareness concerns the need for practitioners to prevent personal and emotional feelings from detracting from their work performance. For instance, a range of occupations involve practitioners reacting to and dealing with traumatic or gruesome situations. Apparently, it is easy for novice practitioners to allow their emotions to take over, thereby inhibiting them from responding to the situation in a sound professional way. But equally, it seems it is counterproductive to attempt to deaden all emotional responses. Rather, it appears that practitioners need to develop from experience a personal emotional know-how that allows them to keep their emotions in check (see Hager and Halliday 2006: 229). Interestingly, stage three of the Dreyfus expertise model, 'competence', includes the personal practitioner qualities of a sense of responsibility for and emotional involvement in one's practice (Dreyfus 2001: 36).

The above examples illustrate some of the complex ways in which, for the integrated understanding of competence, professional judgement lies at the heart of practice. We turn now to a consideration of some limitations of the integrated approach.

10.4.4 Limitations of the Integrated Understanding of Competence: Real and Imaginary

A very important limitation is that the integrated understanding of competence accepts that no matter how well they are developed, the competency standards never are, nor ever could be, a complete or comprehensive description of the practice of the occupation. This is so for several reasons. Firstly, as the above examples illustrate, competency standards cannot capture crucial tacit aspects of practice. Competency standards are able to describe procedures and outcomes fairly specifically. But the realities and complexities of actual practice, some of them tacit, underline the limitations of such descriptions. The capacities needed for practice include dimensions such as the involvement of the whole person including their emotions that are outside of the scope of accurate description in generic standards.

The same applies to the holism of professional judgement. As has long been known, expert practitioners know more than they can say.

A second reason why competency standards are necessarily incomplete is that they are always a work in progress. Professions and other occupations continually change and evolve, some more rapidly than others. This continuous change is driven by many factors, such as the growth of knowledge and understanding, technological developments, and changing social and environmental factors. This means that the integrated competency standards need regular updating. In any case, it was always delusory to think that occupational competency standards might cover every possible contingency that conceivably might arise in practice.

A supposed limitation of competency standards in general is that they promote impoverishment of curricula. It is easy to see how this impression has arisen. If a task-based set of competency standards is assumed to be a curriculum list of the items to be taught and assessed sequentially in a CBT course, then poor quality training will be the inevitable outcome. This naïve approach is what has happened in some CBT courses. Yet, as argued earlier, competence is more about 'putting together' the parts in contextually suitable ways, than it is about performing discrete tasks in isolation. So treating competency standards as a curriculum is erroneous. At best, competency standards offer valuable guidance for the development of a curriculum.

Since integrated competency standards detail practitioner knowledge, abilities, skills and attitudes displayed in the context of realistic professional tasks, they offer considerable scope for informing and assisting educational providers in terms of course content, teaching strategies and assessment procedures. However, it needs to be stressed emphatically that considerable interpretation and judgement is required to employ competency standards to inform development of a curriculum document. Some might see this as a limitation, but that is an erroneous perception. Curricula and competency standards operate on quite different logics. A curriculum (literally a 'course to be run') describes a *process* for attaining prescribed learning outcomes, whereas competency standards describe a set of outcomes, namely, good practice of an occupation. So even if a training course could achieve all of the outcomes represented by the competency standards, it is still a mistake to treat the standards as a curriculum. The standards merely describe outcomes, not the kinds of processes suitable for learners to attain the outcomes. But there is a further complication.

The holistic seamless know-how that underpins highly skilled or expert performance cannot be produced by formal education alone. It appears to require significant practice experience for its development. The preceding discussion of the self-awareness and personal style aspects of situated professional judgement provides excellent examples of crucial learning that can only result from real practice. Various professions have long been aware of this. Graduation from the undergraduate course is but an initial step towards full qualification to practice. Typically this entails a period of supervised or limited practice – internships, professional years, probationary periods, etc. – until the novice practitioner is deemed fully workplace competent. Though various tertiary course providers have sought to 'close the gap' by strengthening the practicum components of their formal courses, it seems to be

unrealistic to expect formal courses to produce graduates who are fully workplace competent. Rather, done well they produce graduates who are workplace 'ready', i.e. ready for a period of further learning from actual practice in order to fully meet the competency standards. As just noted, many professions are not prepared to leave to chance this period of further learning from actual practice. They provide guided and supervised practice that must be completed satisfactorily before the novice is deemed competent to practice independently. It is this kind of crucial learning from real practice, which is necessary for attaining expertise, that has helped to simulate recent interest in the concept of workplace learning. By now, it should be doubly clear why it is an error to confuse competency standards with a curriculum (see Hager and Gonczi 1996 for further discussion of these issues).

Another supposed limitation of competency standards is reflected in the claim that they dictate an excessive uniformity in the ways that practitioners work. Certainly there is more than one correct way to carry out many occupational tasks. But the argument here rests on the false assumption that 'standards' implies 'standardisation' of work processes. But the reality is that the standards describe what satisfactory outcomes look like and, in most cases, leave it open as to how the outcomes are to be achieved. Certainly, the professional competency standards that have been employed in Australia encompass professional discretion and diversity, e.g. they do not prescribe that all practitioners will necessarily act in the same way in a particular situation. So standards based on the integrated conception of competence allow for appropriate flexibility in work performance. They are consistent also with the reality that not all practitioners will have identical overall conceptions of their work. For instance, a physiotherapist in the employ of a community health centre will practise, very likely, somewhat differently from a fellow practitioner who operates their own private practice. Yet in both cases, they will perform their work according to the integrated competency standards for physiotherapy. Clearly if we assume a narrow task understanding of competence, it might appear that all competent performance is essentially identical. However, once we go deeper and add the integrated approach's inclusion of attributes that underpin performance and their contextualisation, there is the obvious possibility that different combinations of attributes can lead to the same satisfactory outcome or, in some cases, even different outcomes that are equally satisfactory.

A further supposed limitation of competency standards is that, because they prescribe minimum standards, they thereby discourage excellence. Everything, it is claimed, is reduced to the lowest common denominator. However, by the same logic, we could claim that traditional examinations discourage excellence since there is a minimum mark (commonly 50 %) for gaining a pass. However, when it comes to integrated competency standards, this view is based on a complete misunderstanding. For the 'discouraging excellence' charge to be valid, the competency standards would need to describe tasks that admit of no degrees of quality of performance, i.e. either a practitioner can do it or they cannot. But such 'on-off' tasks are either rare or relatively minor in many occupations. Typically, the standards describe tasks that can be performed more or less well, i.e. the level of performance can be normatively appraised. In assessment involving integrated competency standards,

this feature is enhanced since the recommended assessment is of holistic slices of actual practice. Typically these assessments address two or more of the key tasks simultaneously. So in sound competency-based assessment, a prescribed minimum satisfactory level of performance is entirely consistent with performances being judged against a full range of criteria from excellent through to fail (for a discussion of the kinds of standards, called 'described standards', that are appropriate for tasks that are open to many degrees of performance, see Gonczi et al. 1990). Of course the normal situation is that most candidates assessed against integrated competency standards will greatly exceed the specified minimum performance levels, just as most entrants to courses greatly exceed the entry requirements. So blanket claims that competency standards' discourage excellence are unfounded, at least in the case of integrated competency standards.

As this section has argued, the integrated view of competence can be summarised as *contextualised capability involving an integration of knowledge, skills and attitudes*. As against the atomism of many approaches to competence, the integrated view stresses the inescapable *holism* of professional performances. Thus, rather than focusing on ticking off a checklist of atomised tasks and skills, the integrated view asserts that competence is more about being able to seamlessly integrate knowledge, skills and attitudes into a, perhaps unique, professional performance that answers the needs of the particular situation. Underpinning this capacity to 'put it all together' so as to fashion an appropriate performance is the practitioner's *professional judgement*. It is because professional judgement is applied to contexts and situations that are often unique in some respects that such judgement cannot be fully codified into a set of rules. This is why it is essential that assessment of competence should be carried out only by assessors who are themselves competent to carry out the kinds of performances that they are assessing. In a nutshell, reliable and valid assessment of a practitioner's professional judgement itself depends on informed professional judgement. Another important distinguishing feature of the integrated view of competence is that a practitioner's competence is not itself directly observable; rather competence is inferred from performances that are themselves observable.

10.4.5 Practical and Procedural Aspects of the Development and Use of Integrated Competency Standards

Firstly, as noted earlier, professions and other occupations continually change and evolve, some more rapidly than others. This means that the integrated competency standards are always a work in progress. They require regular updating and refinement. Each successive version of the competency standards should be a product of group professional judgement. There needs to be ample opportunity for many and representative interested practitioners to contribute to the achievement of overall consensus.

Secondly, integrated competency standards are used for many and diverse purposes including the following:

- They provide members of the occupation with a guide to planning personal career paths. This can be important in those professions and other occupations that have a variety of levels and specialisms.
- They provide a basis for assessing and recognising the capacities of overseas qualified practitioners seeking to migrate to other countries to practice a registered occupation.
- They provide professional and other occupational authorities with a basis for determining refresher course content for those seeking to return after a significant absence from practice of the occupation. This issue is important for registered occupations.
- Potentially they provide the public with direct knowledge of what might be expected of a competent practitioner in a particular occupation. (In practice, however, most members of the public rely on the accreditation, regulation and licensing systems for professions and other key occupations to warrant that practitioners have the knowledge skills and dispositions to perform competently. However, the processes of accreditation of practitioners, whether at initial or higher levels, are increasingly based on competency frameworks, whether or not a registration model is also in use).
- They are employed by universities and other higher education providers, vocational education providers and professional and other occupational authorities as an important guide for designing initial professional and vocational preparation courses, higher-level courses (e.g. master's) and ongoing professional development programmes.

However, it should be emphasised that the competency standards' document by itself does not provide all the answers for each application. Rather it is a valuable starting point for designing a process that will serve to accomplish the required purpose. Typically this will include contextualising and elaborating parts of the competency standards as tools suitable for achieving the particular purpose. For instance, in the case of returners after a period away from practice, a key consideration will be: in which aspects of the standards do (say) 5 years absentees need updating? Likewise for (say) 10 years absentees, etc. On this basis, refresher course curricula, assessment arrangements, etc. can be designed. A different application of competency standards concerns the admission and registration of overseas-trained practitioners. The standards will serve to decide, firstly, the nature and content of preliminary screening of applicants, such as what evidence is to be supplied by candidates (case notes, qualifications, experience, etc.). Secondly, for those candidates accepted for migration, the competency standards will serve to decide what aspects of practice need to be tested and what levels of attainment are required prior to registration. Evidently then, each particular use requires some expansion of and contextualisation of some or all of the standards. This expansion and contextualisation results in different levels of detail and explanation according to the very different purposes. In all of this, group professional judgement is at the heart of decision-making.

Both of these practical and procedural aspects of using integrated competency standards reinforce the key point, made earlier, that *professional judgement* is a fundamental underpinning notion for such standards. Clearly, in virtually all instances, *group* professional judgement is more secure than the judgements of one or a few individual practitioners.

This above account of integrated competency standards fits well with prominent recent theoretical developments. The next section addresses this.

10.5 Relation of the Integrated Understanding of Competence to Recent Theoretical Developments in Related Topic Areas

Near the beginning of this chapter, it was noted that in the early 1990s, when colleagues and I first developed the integrated understanding of competence, we found the literature surrounding competence and professional practice to be disappointing. In particular, we concluded that received theories and concepts (such as skill formation, reflective practice, learning by doing, or the application of theory to practice) did not adequately account for the richness and diversity of the holistic skilled performances that we were witnessing as part of our work. Fortunately, in the intervening quarter of a century, theoretical understanding of these matters has advanced considerably. In this section various theoretical developments that are relevant for enriching our understanding of the integrated approach to competence are outlined and discussed.

10.5.1 The Nature of Skills

Skills have often been regarded as discrete, self-contained entities that can be acquired by practice and passed on to novices (see Hager and Halliday 2006: 124–5). This line of thinking encourages the idea that a skilled occupation can be reduced to a set of discrete skills. As noted earlier, this assumption underpins much CBT. However, a much more holistic approach is evident in more recent work on skills. A homely example will serve to demonstrate why a degree of holism is essential to any convincing account of skills. The familiar example concerns the skills required to competently drive a motor vehicle. A set of discrete skills (starting the engine, activating the left turn indicator, accelerating the vehicle, applying the brakes, etc.) can readily be identified. Imagine that a complete list of basic motor vehicle driving skills had been identified. The crucial question is this: if someone demonstrates the ability to perform each of these discrete skills, one by one, would we be justified in concluding that they were a skilled, or even a competent, motor vehicle driver? Clearly not. It seems to be obvious that skilful driving requires something more than being adept at each of these discrete skills. Someone whose

training had not advanced beyond performance of each of the discrete skills might well be a very unskilled motor vehicle driver. This is so because skilful driving requires a capacity to 'put it all together' appropriately for the given context. Skilful drivers enact a holistic performance that is adapted to the particular road and traffic conditions and many other variables that obtain at a given time. In short, skilful driving consists not so much in the ability to perform discrete skills but, crucially, in the capacity to put them all together in effective combinations that are appropriate to current conditions. This more holistic notion of skill encompasses the so-called discrete skills but incorporates as well abilities, such as judgement, perceptual discrimination and forward planning; affective characters, such as persistence and attention to detail; as well as various learned techniques and habits.

Dictionaries frequently distinguish between two senses of the term *skill* – the 'uncountable' and 'countable' senses. The former represents a wider, more holistic understanding of skill. It is the 'putting it all together' aspect of skilful driving. The dictionaries present this 'uncountable' sense of skill as the primary one. The latter sense covers specific discrete skills that can be listed and described. For instance, the *Oxford Advanced American Dictionary* defines skill in the uncountable sense as 'the ability to do something well', whilst skill in the countable sense refers to 'a particular ability or type of ability'. Examples of the uncountable sense include 'The job requires skill and an eye for detail' and 'what made him remarkable as a photographer was his skill in capturing the moment'. Examples of the countable sense include 'we need people with carpentry skills' and 'she shows good management skills'.

Likewise the above motor vehicle driving example also supports the claim that the uncountable sense of skill is the primary one, since skillful driving is an uncountable skill in the sense of 'the ability to do something well'. By contrast, the components of the complete list of basic motor vehicle driving skills are clear examples of skills in the countable sense. That the uncountable sense of skill is indeed the primary one is supported further by considering typical applications of the terms 'skilled' or 'highly skilled'. A professional orchestral cellist is clearly someone who is highly skilled as a cellist. Underpinning this capacity, there are numerous countable skills relating to the mechanics of cello playing, reading music, etc. But overlying this is the uncountable sense of skill and musicality by which a holistic performance is fashioned and delivered that takes into account and responds to multiple factors such as the particular preferences of the conductor, the playing of the cello section as a whole, the role of the cellos in the overall orchestral fabric of the particular work, the audience, the vagaries of the venue and so on. Similarly, the superior skills of professional sportspeople consist primarily of skill in the uncountable sense. For example, numerous discrete physical and mechanical skills can be attributed to a batsman who scores a test match century. But the real skill that the sporting public admires lies in the way these discrete skills are subsumed into an overall performance that is well suited to the prevailing circumstances and conditions. Taking just one example, a cover drive for four by the centurion is not just the mechanical reproduction of the stroke as prescribed in a coaching manual.

Rather, it is the stroke adapted to suit and allow for many factors including the prevailing pitch conditions, the wind (including its changes), the condition of the ball (e.g. whether reverse swing has started), etc. So the batsman's playing of a particular stroke is not just the performance of a set of one or more discrete, isolated physical skills. Rather significant perceptual awareness and know-how are deployed to shape the actual instances of executing this and a myriad of other skills involved in the overall highly skilled innings. These two examples also exemplify the point that whilst skilled performance often involves significant physical skills, it also usually involves much more. In this respect, they reflect the numerous dictionary entries that list the arts, crafts and sciences as typical sites of skilled performances.

These holistic considerations are reflected in more recent accounts of skill (e.g. Winch 2010; Beckett and Mulcahy 2006; Hager and Halliday 2006: 124–125). Winch's account is instructive. For Winch 'to act skilfully is not to perform a type of act, but to act in a certain (praiseworthy) way' (2010: 43). As Winch puts it:

> The concept of a *skill* seems to be the ability concept which opens up the vista of normative appraisal in terms of the *degree* to which an activity can be performed well or badly. (Winch 2010: 41)

Winch regards this feature, of being subject to normative appraisal, as the defining feature of skills. As well, Winch holds that skills are a subset of abilities, i.e. skills are those abilities for which normativity is the defining feature.

The *Cambridge Online Dictionary* defines skill as 'an ability to do an activity or job well, especially because you have practised it'. Since there typically are degrees for how well an activity or job is performed, this definition implies that skilled performances can be normatively evaluated. It is noteworthy that the uncountable sense of skill fits naturally with the notion of normative appraisal, whereas this is less so for the countable sense. This is evident from the fact that many countable skills, being discrete, specific and physical, are the kind of thing that one can either perform them or one cannot. Simply, there are no *degrees* of how well they can be performed. Overall, these various ideas strengthen the claim that the uncountable sense of skill is the primary one. This sits well with the claim of this chapter that the holistic integrated understanding of competence is greatly preferable to narrower approaches.

Whilst acknowledging that skills involve the use of method or technique, Winch adds that 'it is plausible to suggest that skill involves more than this' (Winch 2010: 43). According to Winch (2010: 43–44), this something more includes most or all of the following components:

- Physical capacities
- Technique
- Moral qualities (such as persistence and attention to detail)
- Habits (such as taking care of one's equipment)
- Refined perceptual discrimination
- Knowledge (which is often displayed enactively rather than verbally)
- Judgement

By incorporating most or all of these components, skills are shown to be *complex* entities. As

Winch puts it: 'to possess a skill is to possess something complex, with different integrated and interrelated aspects' (Winch 2010: 44). This complexity is evident for each of the three examples of holistic skills mentioned above (driving a motor vehicle, professional orchestral playing, test match cricketing). In each case, physical capacities need to be guided by and integrated with items such as persistence, attention to detail, habits, refined perceptual discrimination and judgement.

Significantly, Winch points out that this complexity is missed if accounts of skills focus just on the *tasks* to be performed. Confusing tasks with skills effectively overlooks key features of skills resulting in a thinner, austere version of what is actually a much richer concept. Winch calls this error 'conceptual deflation' (Winch 2010: 45). As argued above, over recent decades many attempts to implement competency-based training have foundered on just this error.

Actually, there is yet a further reason for the frequent occurrence of this widespread error. It is traceable to the fact that task descriptions are amenable to minute and detailed specification. The degree of specification can be easily adapted to fit the requirements of the particular situation. The opposite is true of the exact specification of the kinds of human attributes required for competent completion of the task. The identification and elaboration of human attributes is much more elusive and contested (see Hager 2004). The Winch list of skill components (two paragraphs above) points to the difficulties in specifying clearly and unequivocally the details of this side of skilled performance. Perhaps because of this asymmetry, versions of CBT tend to concentrate on what is seemingly more objective (task descriptions) and avoid what is more subjective and intangible (the human attributes that underpin skilled performance).

This recent work on skills obviously has many strong synergies with the integrated understanding of competence. Holism, contextuality and professional judgement, all central to the integrated approach, are each closely allied with skilful performance in the uncountable sense of the term. A competent practitioner will also be a skilful performer.

10.5.2 Practice Theory

The last 20 years have witnessed a distinct 'practice turn' in social sciences theorising. The practice turn appeals to human practices as the fundamental bearers of understanding, intelligibility and meanings. This means that the mental entity concepts that characterised earlier theorising (beliefs, desires, emotions and purposes) are replaced by concepts associated with human practices (embodied capacities, know-how, skills, tacit understanding and dispositions). This is not the place to provide a detailed account of the practice turn (see, e.g. Schatzki et al. 2001; Green 2009; Kemmis 2005, 2010; Hager et al. 2012). Instead a brief outline will be given of diverse approaches to practice theory. Then, some major features common

to many of these practice theories will be discussed for the light they shed on the integrated approach to competence.

The practice turn has been influential in diverse disciplines in the humanities and social sciences. Its impact is increasingly evident in recent writings on education and learning. One prominent aspect of the growing literature on practice is that most authors seem to take the meaning of the term 'practice' to be unproblematic. Yet 'practice' is used in very diverse ways in the literature. Kemmis (2010) offers a detailed analytical classification of these diverse uses. For present purposes, it will suffice to distinguish more inclusive from less inclusive accounts of practice. More inclusive accounts accept almost any human activity as a practice, whereas more exclusive accounts restrict the scope of practices to more substantial and complex organised activities such as professions and occupations. Clearly it is the more exclusive accounts of practice that are most relevant here. (Hager 2012a offers a detailed account of the less exclusive/more exclusive continuum and the different purposes served by the different usages of the term).

For more exclusive accounts, practices are:

> … complex holistic activities, ones that integrate… diverse items such as goods and virtues, activity, experience, context, judgement, with such integration often involving a significant temporal dimension. (Hager 2012a: 27)

Some major themes that characterise more exclusive accounts of practice theory (adapted from more extended discussions in Reich and Hager 2014 and Hager 2012b) are:

1. *Knowing in practice* – professional learning is closely entwined with knowing, practising and innovating. It falls in between habits and actions and occurs as practitioners practice.
2. *Sociomateriality* – practice and professional learning occur in *sociomaterial arrangements*, in interrelated sets of material entities: humans, artefacts, organisms and other objects.
3. *Embodiment* – practices are not limited to cognitive functions but are embodied, both in a practitioner's own body and between their own and other bodies and material things.
4. *Relationality* – practice and associated professional learning involve much more than the contents of individual heads. Its relational and collective characteristics invoke notions such as professional collaboration, teamwork, choreography and orchestration.
5. *Historical and social shaping of practices* – practices exist and evolve continuously in historical and social contexts, shaped by complex social forces, including power.
6. *The emergent nature of practices* – they change and evolve over time in ways that are not fully specifiable in advance.
7. *Normativity* – practices typically have a strong normative dimension, i.e. features that an activity must have in order count as an instance of that particular practice. However, normativity is a much richer than mere rule following or rigid adherence to standard procedures.

Most of these major themes from practice theory (knowing in practice, embodiment, relationality, historical and social shaping of practice and normativity) have their obvious counterparts in the integrated understanding of competence as detailed above. Of the others, sociomateriality serves to remind us of aspects of contextuality and relationality that may be sometimes overlooked. The theme of the emergent nature of practices adds weight to the notion that competency standards are always a work in progress. Also it provides a further argument for the claim made earlier that, necessarily, competency standards can never be comprehensive. Practice theory offers new ways of thinking about practice and learning and the relationships between them. The close correspondence between practice theory and key aspects of the integrated understanding of competence helps to explain the latter's ongoing durability for those occupations that have adopted it.

Although he would not be regarded usually as a mainstream practice theorist, David Guile's recent work (Guile 2014a, b) has strong resonances with several of the themes discussed above. His research focuses on 'the forms of relationship between knowing, learning and acting in and between the contexts of education and work' (Guile 2014a: 80). His key concept for analysing this relationship is *recontextualisation*. For Guile, three principles underpin recontextualisation as follows:

1. The *purpose* of an activity determines how those involved in the activity deploy resources (conceptual, material and social) to accomplish the activity. Guile maintains that the purpose of an activity serves to set up a mediating relationship between theoretical and practical knowledge. Purposes, of course, are key features of both competency standards and practices as discussed above. It is precisely the purpose of the occupation that gives shape to the competency standards and provides a rationale for the choice of 20–30 key tasks that distinguish the occupation.
2. All forms of human activity (theoretical and practical) occur in a *normative context* where conceptual and empirical claims are both judged. For Guile, the crux is that practitioners of the activity make conceptually structured professional (i.e. practical) judgements in context-specific circumstances. This, of course, resonates strongly with the integrated understanding of practitioner competence.
3. Theoretical and practical (i.e. professional) reasoning presupposes *inferring* what follows from different types of concepts or actions and responding accordingly in specific situations. This puts an emphasis on the relationality of thinking, acting and planning, with suitable judgement underpinning it all.

The main upshot of all of this is that for Guile, human judgement is the primary unit of knowledge. In effect, Guile is shifting the focus of epistemology from its traditional concentration on the contents of minds to a more pragmatist (in the philosophical sense) concern with humans' capacities to interact effectively with their environments. Once again, this resonates strongly with the principles and concepts that characterise the integrated understanding of competence.

10.5.3 Complexity Thinking

Employing complexity theory to elucidate work and learning is a project still in its infancy. Here the term 'complexity thinking' is preferred in recognition of the fact that there exists a variety of different complexity theories (Lancaster 2012 and 2013). Nonetheless, two basic and widely accepted themes across all complexity thinking are its crucial focus on the *relations* between entities and the idea that novel qualities, entities or patterns can *emerge* from the interrelationships between the entities in a complex system.

10.5.3.1 A Focus on the Relations Between Entities

Complexity thinking posits that the relations between entities (complex systems) are as ontologically significant as are the entities themselves. This does not entail that the entities themselves are irrelevant, but it does mean that structure is understood as emerging from processes of relations between entities. This contrasts with traditional substantialist thinking, according to which structure consists of an assemblage of entities. In short, a complex system is structured by its relations, rather than by its constituent entities as the building blocks. Complex systems are constituted by the emerging patterns of the relations that characterise their processes (Cilliers 1998 and 2000).

10.5.3.2 Emergence in Complex Systems

Emergence is a key concept that characterises complexity thinking. It is 'the arising of novel and coherent structures, patterns or properties during the process of self-organisation in complex systems' (Goldstein 1999) or 'the coming into existence of new forms or properties through on-going processes intrinsic to the system itself' (Lewis 2000). Emergent phenomena are neither explicable by, nor fully predictable from, the qualities or processes of the original entities or their interrelationships. Emergence entails the prior presence of relational processes – structure, properties, systems or entities appear as emergent from a relational base. These relational processes constitute the 'micro'-level of emergence and are characterised by irreducibly different relations from those that characterise the emergent 'macro-'level function. This creates an irreducible distinction between micro- and emergent level functioning. However, the two levels are related to one another. The range of possible characteristics of the emergent macro-level phenomena is necessarily constrained by the nature of the relations that characterise the micro-level functioning that gave rise to them. But equally, the emergent macro-level entities or properties may serve to alter the environment of the micro-level functioning, resulting in changes at that level.

As the definitions above demonstrate, emergence is inextricably linked with underlying or preceding processes, which are characterised by relations. There is a tendency in the current literature on complexity to assume that these relations are simple interactional ones, such as the spatial relations of flocking birds or those determining sand dune formation. However, as Lancaster (2012, 2013) argues, for social situations, where actions are the product of human choices and intentionality, transactional relations are crucial and more relevant. In transactional relations, the related entities themselves are altered by the relation, whereas mere interactional relations leave the related entities basically unaltered.

Other complexity thinking concepts that are important for understanding human social practices as complex systems are *attractors* and *autopoiesis*. In complexity thinking, the attractor concept describes a complex system's limits. It defines a set of states through which the complex system's functioning moves, and to which it returns after it has been perturbed. Should the complex system move beyond these limits, it in effect falls into a new 'attractor basin', thereby becoming a new or different complex system. Human practices can be thought of as complex systems with various subgroupings within the practice constituting complex systems within the larger complex system. The attractor concept offers insight into the persistence or otherwise of the overall aims or purposes of the particular social practice, as it is affected by the sometimes shifting aims or purposes of particular subgroupings within the practice.

Complex systems can function autopoietically. That is, they can be both open to information and other resources from their environment and also operationally closed, in that they can set their own boundaries and monitor their environment so as to adjust their internal arrangements in the service of their own purposes/needs. Once again, this concept is very suggestive for thinking about human social systems and practices as complex systems.

Underpinning these various complexity thinking themes is the premise that the world is infinitely complex and, hence, can never be fully known. Humans gain understanding of aspects of the world by *reducing* complexity, i.e. by choosing which aspects of the complex whole to attend to and which to ignore. So human theorising always involves some reduction of complexity.

There is, of course, much more to complexity thinking than these few introductory ideas. But even this is enough to indicate how complexity thinking might well offer new insights into the matters covered in this chapter. Earlier we saw that competence can be conceptualised in various ways. Much of the literature concerns debate about which one of these is the correct one. Complexity thinking suggests that different approaches to competence represent different choices about how far to reduce complexity. Clearly, the task approach to understanding competence reduces the complexity of occupational practice much more that does the integrated approach. Rather than asking which one is 'correct', perhaps we need to focus more on how well each approach serves its intended purpose? We earlier found that even integrated competency standards need to be adapted and contextualised for different

uses. The choices here reflect perhaps decisions about what level of complexity is needed for the particular purpose.

Further, an occupation or profession can be thought of readily as a complex system with its own broadly agreed attractor, one that in turn consists of many other complex systems within this complex system. We can think of (say) a profession in terms of systems at different levels. For instance, a national professional association can be viewed as the profession at a fairly macro level, whilst a member of the profession working with clients represents the micro-level of the profession. In between are other levels – state associations, special interest groups, peer learning groups, etc. All of these various levels are interrelated. Many of these will have their own distinctive attractors, which will be significantly related to the macro-level attractor that drives the profession as a whole. Achieving knowledge of this multiply complex system will require many different levels of understanding. For instance, the profession's integrated competency standards, ethical standards statement, practice protocols and other similar documents will be highly pertinent for understanding practice at the national level. However, it will require gathering of much more micro-level data to understand the similarities and differences between the practice of various members operating in diverse contexts. The latter each constitute a complex system within the larger complex system. As complexity thinking suggests, we also need to understand the various relations between these subsystems and the larger system, as well as the relations between the subsystems themselves. As this complex system and its subsystems evolve autopoietically, genuinely novel emergents are likely.

This necessarily short discussion of complexity thinking suggests that, as its influence expands, it promises to add considerably to our understanding of the issues covered in this chapter.

10.6 Conclusions

Competence approaches have been subjected to harsh judgements in much educational literature (e.g. Ashworth and Saxton 1990; Hyland 1994 and 2014). This chapter has argued that this reflects an impoverished understanding of the concept on the part of both naïve practitioners and critics. A richer understanding of competence has been outlined and defended in this chapter. It has been employed successfully over many years by many occupations. This success should come as no surprise since this richer understanding of competence has strong synchronicity with some of the best thinking in both its own and related fields.

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Chapter 11
Competence and the Alignment of Education and Work

Martin Mulder

11.1 Introduction

The competence movement which started in psychology, testing and selection in the 1950s in the USA has influenced education policymaking and practice during the late 1960s. The essence of the movement was to align education with the world of work, a challenge which is still on the international education policymaking agenda, especially in the sectors of vocational and professional education. However, the implementation of what became known as competency- or competence-based education was not without problems.

This chapter will give an overview of the issues which are pertinent in the integrated alignment of education and work using the construct of competence. First, some early accounts will be presented regarding the concept of competence in the education literature, which we now can date back to the middle of the nineteenth century. These accounts form the foundation for current key competencies and the essence of competence-based education and professional development. As described earlier (Mulder 2014), the concept of competence was used as a pre-academic construct, as if its meaning was not yet contested. It lasted until the middle of the twentieth century, until the concept entered psychology and was originally seen as an alternative for the Freudian depth-psychological explanation of behaviour which focused on the unconsciousness.

Next, the notion of competence and alignment will be addressed, taking the theory of strategic alignment of intended learning outcomes, learning processes and assessment of learning proposed by Biggs (1999) as a starting point. The argument will be put forward that the model of strategic alignment needs to be expanded for

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vocational and professional education by adding competence frameworks as a component. These frameworks serve as a major input for the decision-making on intended learning outcomes. Furthermore, but that should be part of any model of education, the educational philosophy of the educational institution should be included. Educational philosophy serves as a kind of filter by which various (conflicting) inputs are evaluated to decide which way to go with the planning of educational programmes (Tanner and Tanner 1995).

Next, competence-based vocational and professional education is positioned in the integrated occupationalist approach of competence development. This approach is different from the behaviouristic-functionalistic approach in that it does not focus on trainable behaviours, but on generic competence frameworks which are based on occupational profiles. It is also different from the situational-professional approach, which focuses on professional development in social practices. That approach is typically applicable to continuing vocational education or professional development. Integrated occupationalist competence-based vocational and professional educational practices start with the development of a competence framework, which is typically established in consultations of the respective stakeholders in the world of education and work.

After having positioned competence-based vocational and professional education, the component of competence frameworks is elaborated, and the inputs on these frameworks are presented and discussed. An important feature of competence frameworks is that they define the destination for educational programmes.

Next, the practice of working with competence-based qualifications frameworks will be described. This works out differently for competence-oriented and competence-based educational programmes. In competence-oriented programmes, competence frameworks serve as the frame of reference for formulating the general objectives of the programme, whereas in competence-based education, competencies are the foundation of the various design steps in the process of curriculum and instructional development. In this case competencies are the clusters of knowledge, skills and attitudes which are necessary to perform core tasks or solve core problems in vocational or professional practice.

Subsequently, research on competence-based vocational education is reviewed. This review shows the variety of domains in which competence-based vocational and professional education and learning is being studied. It furthermore shows the diversity in displaying competence frameworks for the alignment of education and work.

Finally, in the last section, the conclusions of this chapter are formulated.

11.2 Early Accounts of the Meaning of Competence in Aligning Education and Work

There are early accounts of the use of competence in the educational literature. These accounts show that the early understandings of competence are still relevant and that they shaped the foundation of what now is called key competence. Aligment

of the worlds of education and work by competence frameworks is an elaboration of the original meaning of competence in educational science and practice. As early in the beginning of the twentieth century, the role of education in the development of competence has been noted. As said in the chapter on conceptions of professional competence in the *International Handbook of Research in Professional and Practice-based Learning* (Mulder 2014), the role of education in competence development was already mentioned by John Dewey and others. Dewey (1916) spoke about competency instead of competence, used the term only incidentally, and did not elaborate on the meaning of the concept. He just used it to express his thoughts about the aims of education. In current terminology, Dewey was stating that education should contribute to the development of a labour market qualification, career development, citizenship competence and self-responsible self-regulation (Langeveld 1945). Of course he used the terminology which was representative of the time of his writing. He spoke about the need for education to enable the development of 'industrial competency' so that people would get 'means of subsistence': about the democratic ideal that everybody should develop competence to choose and pursue a career, on the link between 'industrial competency' and 'good citizenship', and the difference between 'carrying out the plans of others and in forming one's own'.

From the phrases in the book of Dewey in which he used the term competency, it can be seen that he used it in a way that was and still is described in the dictionaries: competence as the ability to perform and to create a livelihood and the right to act in a certain field. Although Dewey's use of the concept of competency is prone to competence as a performance requirement, the judicial meaning of competence is linked to his notion that education should contribute to the realisation of a democratic society and that schooling of people is important so that they can choose their own career. As will be clear, these thoughts of Dewey strongly related to current key competencies in the fields of career, citizenship and self-regulation competence.

Accounts of the concept of competence can be found in other and earlier sources as well. As already stated in an earlier publication (Mulder and Pachuau 2011, 397), a committee from the UK under the leadership of Childs went on a study tour to the USA and Canada to learn about agricultural education. This study tour took place in the early twentieth century, and the report of the committee appeared in 1910, a couple of years before the key publication of Dewey on education and democracy. The use of the term competence was however much broader than in the book of Dewey. In the report (Childs 1910), the concept of competence was already used to refer to issues in educational and professional practice which are still relevant: the competence of farmers (which can be extended to all occupations and professions), teachers and assessors and competence in practical farm operations, science and management. The report even contains the word 'incompetence', indicating that there were a lot of workers and practices in agriculture of which the level of competence was insufficient.

An even earlier source of the use of the adjective 'competent' is the book *A History of Agricultural Education in the United States 1785–1925* of True (1929) (as a side remark: copies of this 460 page book could be procured for 1 US dollar at

that time). Actually it is not a surprise that these early accounts of 'competent', 'competence' and 'competency' are situated in the history of agricultural education, as the development of agricultural vocational-technical education (ATVET) and higher agricultural education (HAE) preceded the development of industrial (career-technical) education and service-oriented education (in domains such as banking, accountancy, insurance, management, purchasing, marketing and communication). Similar accounts may also be found in the history of healthcare education.

In the book of True (op cit), there are various places in which persons, teachers or assistants who are or need to be appointed to conduct educational duties are referred to as being, or having to be, 'competent'. In his description of the movement towards agricultural education in the USA, he describes a certain amount of agencies that he saw were supportive in the establishment of this education sector. There were various types of agencies, one being the State Board of Agriculture. One of these boards, the State Board of Agriculture of Massachusetts, appointed a committee which had the task to develop a manual for teaching agriculture in schools and to promote agriculture by public lectures. The phrase which is interesting here comes from a committee meeting in which the manual *The Progressive Farmer* was commended and in which the committee reported 'that studies of this description might be attended to with much benefit under competent teachers'. The committee meeting was held on January 12, 1853.

The book also describes the work of Eaton, who was a lecturer and appointed by the private college 'The Rensselaer Institute' at Troy, New York. The leadership of the college noted the remarkable teaching approach of Eaton. He did not use an expository method (by showing specimens and giving demonstrations) but he used a productive and constructive approach in which he invited students to collect samples in the field and to construct simple apparatus to do the tests. He suggested that this kind of education should be implemented in small groups of five students who should give lectures and do experiments, '… under the immediate direction of a professor or a competent assistant. Thus, by a term of labour, like apprentices to a trade, they are to become operative chemists' (op cit, 39–42). It is interesting to note that Eaton used the adjective competent for the assistants and not for the professors, implying that they are competent by their education, experience and position.

It is remarkable that in this book already, there is a strong link between the notion of competence and the role of teachers and professional development of teachers. Not all teachers at that time were fully capable of teaching agriculture, and one of the difficulties was the implementation of practice training and working with practical projects. Teacher training institutes were becoming active in establishing continuing teacher professional development courses. This is also visible in a report of the Federal Board for Vocational Education for 1924, in which an account of continuing education of teachers in the field of agriculture represents an early example of competence-based teacher professional development:

> It ordinarily means individual instruction of the teacher at the school he serves by a competent person whose duty it is to carry on such work where needed. It implies going here, there, and everywhere in a State where a teacher is not doing the desired kind of work, and

> staying with him, or going back to him until he gains enough additional knowledge and skill to meet his problems more efficiently. The third effective means for the professional improvement of agricultural teachers in service is the State and sectional meetings of agricultural teachers for conference, demonstration, and practice. (op cit, p. 379)

Early accounts of the concept of competence in the work of Dewey, Childs and True can be characterised as pre-scientific and pre-institutional. They are accounts in which the words competent, competence and competency were used without all reflections about those words as academic constructs in education, although there are accounts in the history of law, which indicate that the competence of law professionals and courts was already a professional and institutional issue at the end of the nineteenth century (Mulder 2014).

11.3 Competence and Strategic Alignment

As said, the early accounts of competence in the educational literature form the foundation of the current discussions about core competencies. Of course, in the course of time, many new competence domains have emerged. But the idea that education should provide competence to get means of subsistence, or in current terminology, prepare students for a labour market relevant qualification, is as a relevant as it was hundred years and more ago, and forms the heart of contemporary national and international vocational and professional education policy development. This section will elaborate these thoughts by linking societal relevance of vocational and professional education which is articulated by competence frameworks to educational alignment theory as proposed by Biggs (1999). Alignment is seen here as the relational positioning and adjustment of the constituting elements of education within the wider context of work and society, in such a way that the elements of education are strategically 'in line' with one another and meaningful in the relationship between education and work. Competence-oriented education is education of which the general aim is to develop more or less specifically formulated competencies. The difference between competence-oriented and competence-based education will be further elaborated later in this chapter in the section on 'Working with competence-based qualifications frameworks'.

Alignment, and especially strategic alignment, is emphasised by Biggs (1999) as an important characteristic of education. Biggs stressed that deciding upon a student assessment strategy depends on the question of what the intended learning outcomes are (cf. Tyler 1949). Without a good definition and analysis of these outcomes, student assessment can be totally invalid. For instance, if an essential intended learning outcome is to be able to defend a proposition in a public dissertation defence, a PhD student should not just be assessed by writing a proposition; he or she needs to be trained in this in a near-authentic assessment situation (e.g. in a staff or PhD student meeting), thus simulating the social context in which the desired performance can be practised. Like the idea that competence plays a certain role in education and society, the idea that alignment is important is not new. Various

authors within the educational sciences have suggested that multilateral adjustment of key components of the education and learning process is essential. In fact, this idea is the essence of whole models of education or teaching, in which many factors are included, as they all have a certain influence on what is happening in education and learning, and the ultimate learning results in terms of constructed knowledge. An example of this view on the internal relationships between educational objectives, learning experiences, the organisation of education and the evaluation and improvement of education can be found in the work of Tyler (1949). Comparable components of education were later termed as the commonplaces of education or the curriculum (Schwab 1969, 1971, 1973; Goodlad 1984), stressing again the importance of the relationships between these components and the necessity for multi-stakeholder deliberation (Walker 1990) to realise practical solutions for contextualised and thus specific educational challenges.

Coming back to the strategic alignment theory of Biggs, he distinguishes three core concepts which constitute education: the intended learning outcomes, learning and assessment. The core of his theory is, as stated, that these three components are mutually adjusted so as to avoid contradictions between the components. His idea is that learning consists of appropriate learning activities which lead to actual (emerging) learning outcomes. Learning activities are aligned to the intended learning outcomes so that they will result in the desired learning results. Learning processes and results are being tested by assessments which are based on the definition of the intended learning outcomes to establish alignment. So learning, intended learning outcomes and assessment need to be all aligned with one another. Sometimes, the theory of Biggs is used to stress the importance of 'reverse' thinking about educational design, which means that educational design processes should not begin with specifying the intended learning outcomes for learning processes, but that the outcomes should be linked to the assessment strategy and methods first. This is then underlined by the fact that assessment strategies tend to influence the way students prepare for the exams and thus the way in which they learn. This backwash effect should not lead to overemphasising the role of assessment and to an 'assessment first' practice, as it is still the intended learning outcomes that should set the course for an educational programme and not the assessment strategies. The assessment strategies have to follow the intended learning outcomes and precisely measure the achievement of the intended learning outcomes. These considerations, amongst others, have led certain educational researchers to advocate cyclical educational design processes with various iterations before implementing educational programmes (Plomp and Nieveen 2013).

In the field of vocational and professional education, external alignment is important to warrant a productive relationship between education and work or (the international) society at large. Vocational and professional (higher) education have often been accused of being 'irrelevant'. Critiques of employer associations, like 'these graduates (of career-technical education) cannot even hold a hammer', still

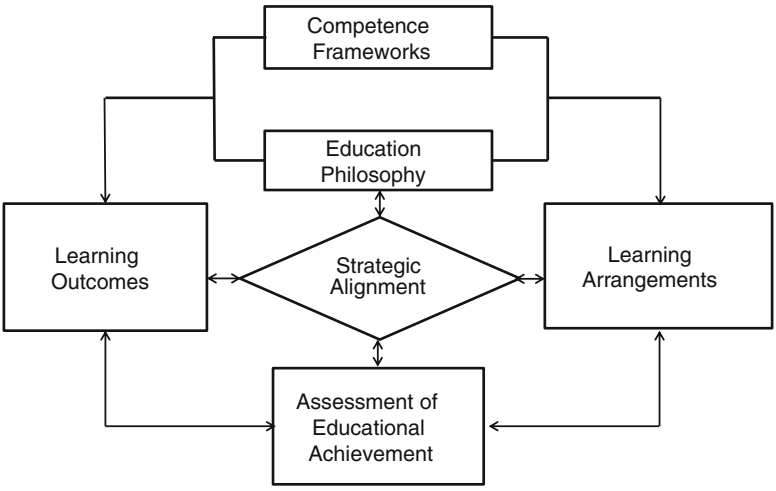

Fig. 11.1 Broadening the theory of strategic alignment for vocational and professional education (After Biggs 1999)

echo in many minds of VET experts. Therefore, in VET and higher professional education, many attempts have been undertaken to strengthen the preparation of graduates for the labour market and society. Already as early in the 1970s, projects started in the USA under the label of competency-based education. The aim of these projects was to deliberately try to get educational programmes aligned with the needs of society. These early attempts to develop and implement competency-based educational programmes are often attributed to shocks in the perception of national achievements. A good example of this is the Sputnik affair, which showed that Russia was more advanced in rocket science than the USA (see Chap. 12 of Barrick, in this volume). This perception led to many efforts in the USA to raise the level of science education and to improve the relationship between education and the world of work (Grant et al. 1979).

To underline this necessary external orientation and outside-in thinking in vocational and professional education, it is proposed to extend the model of Biggs (see Fig. 11.1).

Two components are added to the alignment model of Biggs (the intended learning outcomes, learning activities and assessment of educational achievement), which are competence frameworks as the basis for the definition of learning outcomes and the educational philosophy, based on which decisions are made about the educational objectives, learning processes and assessment strategies, of course within the legal frameworks of the educational institutions.

Two remarks need to be made regarding the additions of the two components in the model.

Firstly, whereas the Biggs, model does not elaborate how intended learning outcomes are developed, it is essential to pay attention to this, which can be done by weighing the various inputs against the institutional educational philosophy. In that sense, the educational philosophy acts as a normative filter by which potential external forces or changes in current practice are being evaluated. This reflects the professional autonomy of the educational institution and its teaching staff. They do not have to take inputs from the outside world for granted; they have their own responsibility of interpreting what is going on outside the institution and deliberate on possible and wishful adjustments of the educational practice.

Secondly, competence frameworks do not 'dictate' the content of intended learning outcomes and assessments. In other words, the model is not deterministic. As said, during deliberations about the educational programmes, the learning of students and the assessment of their achievements, there is a dynamic relationship between these factors and the emerging state of the world of work or society at large. Also, graduates not only need to be able to comply with the requirements of the labour market and their jobs, they also need to be able to contribute to innovation. Therefore, students not only be able to comply with conditions set by employers, they also need innovation competence, not only aimed at improvement but also on transformation where needed.

In this section both competence- and competency-based education are mentioned. The question however is whether they are the same. Generally speaking, competence is defined as the generic capability of people to perform tasks adequately and competency as an element of competence. It that sense, a skilful professional *is* competent and *possesses* a series of competencies. For instance, an assistant professor is called competent if he/she can teach, supervise and publish and conduct acquisition, organisational and societal tasks to an expected level. One of the competencies of this assistant professor is to write an authentic paper for a Q1 journal or to contribute to the further development of the quality of the course he/she is teaching. However, in the literature and daily practice, authors use competence, competency, competences and competencies interchangeably.

11.4 Competence-based Vocational and Professional Education: Integrated Occupationalism

As stated earlier (see Chap. 1 in this volume and Mulder 2014), three approaches of competence can be distinguished: (1) competence and behaviouristic functionalism, (2) competence as integrated occupationalism, and (3) competence as situated professionalism. The first approach dominated the rise of the competence movement in the USA and was related to parallel innovations like modular education and mastery education. The essence was that competence lists were translated in detailed educational elements which were not sufficiently coherent. The third approach predominantly pertains to continuing professional development and stresses the development

of contextualised professional knowledge. The second approach is characteristic of generic or comprehensive approaches of competence-based vocational and professional education. In this approach, competence frameworks are the starting point of curriculum development, the design of learning and instruction, as well as the development of educational tests or assessments. For the alignment of assessments, the pyramid of Miller (1990) is often used, which distinguishes four levels of assessment: (1) knows (knowledge), (2) knows how (competence), (3) shows how (performance), and (4) does (action). Whereas levels 3 and 4 actually both involve performance (it is difficult to show how one does things without actual performance), the four levels have implications for measuring competence. The difference between levels 3 and 4 assessment is that performance is assessed in simulated situations, for instance, with simulation patients (level 3) or in real situations with real patients (level 4).

Competence-based vocational and professional education which can be positioned in the integrated occupationalist approach typically uses competence frameworks as the starting point of macro- (programme and course level) and micro- (lesson and activity) design. The competencies which are included in the frameworks should be of integrative nature, thus enabling the performance of a wide variety of tasks (including new ones) and solving various problems. They should also include statements of knowledge, skills and attitudes, which can be acquired in inspiring and productive learning arrangements.

11.5 Competence Frameworks: Destinations of Educational Programmes

Competence frameworks serve as a programme of requirements for a certain occupation or profession. These frameworks are being used for curriculum development. Such curriculum development is a process of political negotiation and decision-making, whether for a national or an institutional curriculum.

The development of competence frameworks is also a process of negotiated meaning. Just like curriculum development, it is by no means a technocratic or algorithmic process. It involves a series of inputs and stakeholders (see Fig. 11.2).

As said, the process of competence framework development is essentially a social process, which is characterised by social policymaking and negotiation, It is not so much the result of pure empirical research. As such, a competence framework is a normative product and serves as an agreement or a regulation. Therefore, competence frameworks are often endorsed by the key stakeholders in the respective sector, generally referred to as sectoral organisations, which can comprise employers' associations, trade unions, related professional associations and governmental and non-governmental institutions.

Important input factors which can be distinguished are the economy, research, society and politics. To begin with the latter, politics allocates resources, decides

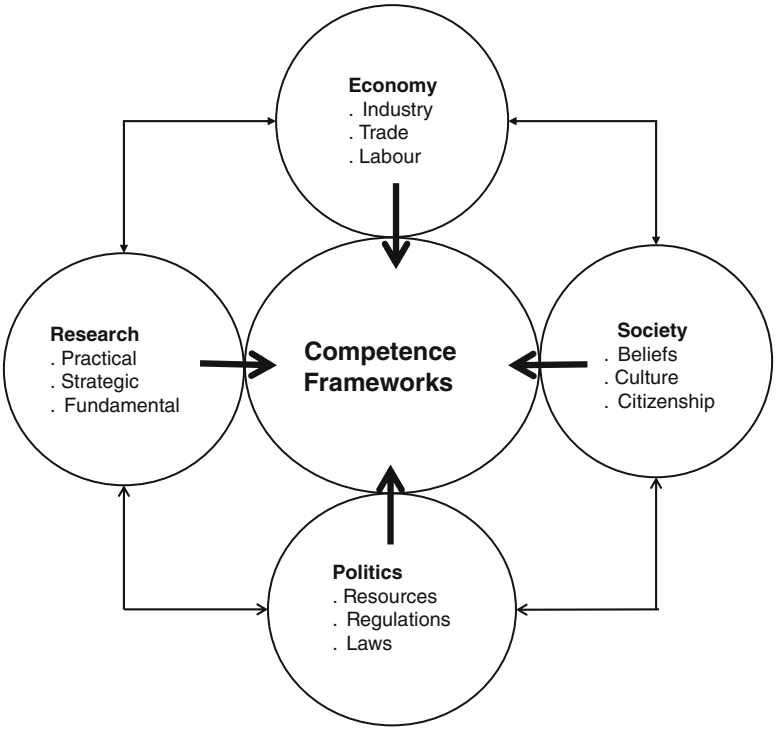

Fig. 11.2 Inputs for occupational competence frameworks for vocational and professional education

upon regulations and enacts laws which influence social practice, including occupations and professions.

The emergent economy and more specifically the industrial sectors, with their state of technological development, trade organisations and labour associations, influence the demand for competence and have influence on the development of competence frameworks.

Society finally influences the development of competence frameworks via societal beliefs, cultural norms and views on citizenship. This all relates to legal frameworks and spiritual beliefs as well, which obviously vary in diversity.

In the literature numerous competence frameworks have been proposed, under the labels 21st century skills, essential learning outcomes, student outcomes, and global competencies. A sample of these is the following.

In the enGauge 21st Century Skills model for 21st Century Learners of the North Central Regional Educational Laboratory and the Metiri Group, four categories of these skills are included: digital-age literacy (e.g. basic, scientific, economic, and technological literacies), inventive thinking (e.g. adaptability, managing complexity, and self-direction), effective communication (e.g. teaming, collaboration and interpersonal skills),and high productivity (prioritizing, planning, and managing for results) (NCREL 2003).

The Association of American Colleges and Universities (AACU 2008) developed essential learning outcomes, and presented these in a model under four headings: knowledge of human cultures and the physical and natural world, intellectual and practical skills, personal and social responsibility, and integrative learning.

The P21 Framework for 21st Century Learning includes student outcomes in the categories core subjects, 21st century themes, learning and innovation skills, information, media and technology skills, and life and career skills (P21 2015).

Vora (2015) proposed twelve professional leadership competencies for the so-called VUCA world, which means the fundamentally Vulnerable, Uncertain, Complex and Ambiguous world. These leadership competencies are very closely related to some of the ones presented under the heading of Competence 3.0 in Chap. 50. The list includes: 'Develop an adaptive mindset, have a vision, embrace abundance mindset, weave ecosystems for human engagement, anticipate and create change, self-awareness, be an agile learner, network and collaborate, relentlessly focus on customer, develop people, design for the future, and constantly clarify and communicate' (Vora 2015).

The OECD (2016) developed a global competency model for an inclusive world, which includes disciplinary knowledge, interdisciplinary knowledge, practical knowledge, cognitive and meta-cognitive skills, social and emotional skills, physical and practical skills and attitudes and values.

None of these competence frameworks however are directly linked to vocational and professional education. They are related to general education and lifelong learning.

At national, institutional and programme levels, there are various instruments which are being used to align vocational and professional education demand and supply. Examples of this at programme level are the working field committees of educational programmes, alumni surveys and education quality management procedures such as critical self-reporting, visitation and accreditation. At national level skills observatories and labour market analyses help. All have a continuous monitoring function and give information about possible discrepancies between what is offered in educational institutions and needed in society, the labour market, occupations, professions and organisations.

11.6 Working with Competence-based Qualifications Frameworks

If competence frameworks are available, the question is how these are used to plan or redesign education to contribute to the development of competence. Here, a distinction has to be made between competence-oriented and competence-based education.

Competence-oriented education is education for which a competence framework is developed which serves as the dot on the horizon. The framework is taken to formulate intended learning outcomes and to align assessment strategies and methods, but the organisation of the learning processes is largely untouched. Principles of social constructivism and activating pedagogy can be used to plan learning activities.

Competence-based education is education for which a competence framework is the foundation of the educational programme. The framework serves to identify core tasks within the occupation or profession, and for these essential competencies are defined. The competencies always consist of clusters of knowledge, skills and attitudes.

So where competence-oriented education uses competence frameworks as destinations, competence-based education uses these as road maps. Competencies are integrated in the curriculum and instructional development and preparation process. Therefore, competence-based education is a much deeper application of using the competence philosophy in education than in competence-oriented education.

An institutionalised example of a competence framework which is typically used in competence-oriented educational programmes is the European Qualifications Framework (EQF), which includes vocational and professional education. The meaning of competence in the European Qualifications Framework as indicated above is related to learning outcomes aimed at achieving certain levels of responsibility and autonomy. This EQF distinguishes eight levels of education, ranging from elementary education to higher and PhD education, and serves as a reference framework for these levels of education throughout the EU. The 'competences' in the EQF are spelled out as follows (source: https://ec.europa.eu/ploteus/content/descriptors–page):

1. Work or study under direct supervision in a structured context.
2. Work or study under supervision with some autonomy.
3. Take responsibility for completion of tasks in work or study; adapt own behaviour to circumstances in solving problems.
4. Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities.
5. Exercise management and supervision in contexts of work or study activities where there is unpredictable change; review and develop performance of self and others.
6. Manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts; take responsibility for managing professional development of individuals and groups.
7. Manage and transform work or study contexts that are complex, are unpredictable and require new strategic approaches; take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams.
8. Demonstrate substantial authority, innovation and autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts including research.

Whereas all education systems in all member states have to grade the levels of their programmes using the EQF, not all have used this to implement competence-based education. Nevertheless, competence levels are defined within the EQF, and

as such, all educational programmes within the EU have to take these levels into account when aligning their qualifications frameworks. So, these programmes are related to the generic competence levels within the EQF and thus can be regarded as competence-oriented. However, this competence orientation is limited, as the EQF comprises knowledge and skills levels as well. They are positioned next to the competence levels (see Mulder 2012). Given the definition of competence used earlier in this volume (Mulder and Winterton 2016, Chap. 1, in this volume), this positioning of competence is at least remarkable, as competence is seen here as detached from knowledge and skills, whereas competence itself is made up of knowledge, skills and attitudes. It is as if in the EQF, competence is something which is comparable to attitudes, but it is not; it is the level at which a graduate is expected to work independently and self-responsibly.

The institutionalisation of competence did not happen without problems, which has been described in a very detailed way by Winterton (2011) in his piece regarding the genesis of the European Qualifications Framework. He has shown that in the course of the years, various trade-offs have emerged. One of these, a major one, is that various member states have decided to follow their own preference in defining the respective national qualifications frameworks. Germany, for instance, had difficulties with accepting the division of qualifications in knowledge, skills and competences categories, as is the case in the EQF. It uses the generic understanding of competence as has been expressed in the competence definition section above. 'Der Kompetenzbegriff spielt im DQR (*the German Qualifications Framework*, editors) eine zentrale Rolle. Er steht nicht – wie im EQR – neben den Kenntnissen und Fertigkeiten, sondern bildet die Klammer für alle betrachteten Lernergebnisse' (Deutscher Qualifikationsrahmen für Lebenslanges Lernen 2013), which means that in the German education system, competence is being perceived at overarching capability and not placed next to knowledge and skills (Kenntnissen und Fertigkeiten). Competence embraces all intended learning outcomes.

The English version of the German Qualifications Framework uses the plural 'competences', which however is a translation of the plural German 'Kompetenzen', which should be translated as competencies, but this actually is a detail. Most important is that competence itself is seen as the overarching integrative set of capabilities which are needed for vocational and professional practice and for effective and productive performance.

To elaborate the German example a bit more, especially regarding the way in which competence domains are being defined, it can be seen that the DQR distinguishes two competence domains: (1) professional competence and (2) personal competence. Professional competence is divided into 1.1 knowledge and 1.2 skills, for long the essence of vocational and professional education, and personal competence into 2.1 social competence and 2.2 autonomy. Below DQR level 4 is presented (source: Deutscher Qualifikationsrahmen für Lebenslanges Lernen 2013, English version: German EQF Referencing Report) (Table 11.1).

It is also interesting to look at the French NQF, which is actually not phrased as a national qualifications framework, but as a national certification framework (Commission Nationale de Certification Professionnelle 2010). The group which

Table 11.1 German Qualifications Framework, level 4

Level 4			
Be in possession of competences for the autonomous planning and processing of technical tasks assigned within a comprehensive field of study or field of occupational activity subject to change			
Professional competence		**Personal competence**	
Knowledge	**Skills**	**Social competence**	**Autonomy**[a]
Be in possession of deeper general knowledge or theoretical professional knowledge within a field of study or field of occupational activity	Be in possession of a broad spectrum of cognitive and practical skills which facilitate autonomous preparation of tasks and problem-solving and the assessment of work results and processes according to consideration to alternative courses of action and reciprocal effects with neighbouring areas. Provide transfers of methods and solutions	Help shape the work within a group and the learning or working environment of such a group and offer ongoing support. Justify processes and results. Provide comprehensive communication on facts and circumstances	Set own learning and work objectives, reflect on and assess such objectives and take responsibility for them

[a]The levels of autonomy are the competences distinguished within the EQF

has been working on the referencing of the French national list of certifications with the EQF has reported the following difficulties. First of all, France has a national certification framework which is more oriented towards the labour market than towards education or 'knowledge' as the group has put it. Secondly it appeared to be difficult to link certain certifications to certain levels within the EQF. Thirdly, the group noted that while working on the referencing exercise, the French list of certifications was discussed and further developed, and by doing this, it was stated that efforts would be made to make the list of certifications more coherent and transparent, like the qualification levels in the EQF.

The UK (Qualifications and Curriculum Development Agency 2010) also uses its own way of formatting its national qualifications frameworks. The plural frameworks is being used here, as within the UK, there are different frameworks for England and Northern Ireland (QCF), Wales (CQFW) and Scotland (SCQF). Within the UK, the different qualifications frameworks also carry the concept of 'credit' in their titles. The QCF is the Qualifications and Credit Framework, as said, for England and Northern Ireland. It contains summary statements, knowledge and understanding, application and action and autonomy and accountability headings. It is remarkable that the term 'competence' is totally absent from the descriptors of the reference levels, which may be the effect of the skills development agenda in the UK. However, at the semantic level, the summary statements and the description of

the autonomy and accountability levels in the QCF can be compared with the descriptions of the competences in the EQF.

Level	Summary	Knowledge and understanding	Application and action	Autonomy and accountability
Level 4	Achievement at level 4 reflects the ability to identify and use relevant understanding, methods and skills to address problems that are well defined but complex and nonroutine. It includes taking responsibility for overall courses of action as well as exercising autonomy and judgement within fairly broad parameters. It also reflects understanding of different perspectives or approaches within an area of study or work	Use practical, theoretical or technical understanding to address problems that are well defined but complex and nonroutine. Analyse, interpret and evaluate relevant information and ideas. Be aware of the nature and approximate scope of the area of study or work. Have an informed awareness of different perspectives or approaches within the area of study or work	Address problems that are complex and nonroutine while normally fairly well defined. Identify, adapt and use appropriate methods and skills. Initiate and use appropriate investigation to inform actions. Review the effectiveness and appropriateness of methods, actions and results	Take responsibility for courses of action, including, where relevant, responsibility for the work of others. Exercise autonomy and judgement within broad but generally well-defined parameters

Although the wording is not exactly the same, it is clear that the level 4 summary, autonomy and accountability descriptions within the QCF are similar to the EQF level 4 competence description. Given the definition of competence used in this volume, the QCF descriptors' knowledge and understanding, application and action and autonomy and accountability would all fall under the umbrella concept of (generic) competence.

Although the development of national qualifications frameworks was not easy and a time-consuming process, according to a Cedefop study, a total of 38 countries developed a NFQ before early 2015; these countries were the 28 EU member states, Albania, Bosnia and Herzegovine, the former Yugoslav Republic of Macedonia, Iceland, Liechtenstein, Montenegro, Norway, Serbia, Switzerland and Turkey (Cedefop 2015). It is clear that there are various differences between the frameworks. These differences will become more evident in part II of this volume, in which competence-based education is presented as a global innovation with multiple morphologies.

The differences are further extended to sectoral qualifications frameworks. A sectoral, or a domain-specific, competence-based qualifications framework can consist of descriptions of work processes to which competencies are linked and work activities are being specified. A domain-specific qualifications framework is used to develop curriculum profiles by identifying core tasks, core problems or core work processes in the framework and selecting these as the building blocks of the curriculum. Subject matter from different disciplines and practical learning tasks is then combined to teach a curriculum unit to the students. Assessment is being done at the level of the core task, problem or work process, preferably in an authentic or a practice simulation situation. Typically, this integrated or generic form of assessment takes it that knowledge elements and skills do not need to be tested in isolation, as they are all integrated in the core task, problem or work process, which in essence may be true, especially when higher levels of complexity are involved. At a lower level, this may be incorrect as via imitation students may be able to perform tasks within understanding the reasons behind the desired performance. This is why understanding is checked by asking students to explain why they perform a certain task in a certain way, although the level of verbalising reasons to justify practical activity may also be limited at lower levels of education.

This approach of identifying work processes and activities and linking these with generic competencies has been followed in the Netherlands, which was quite problematic, as a generic set of competencies was chosen from which a selection of specific competencies was taken, such as ‘analysing’ and ‘communication’. As generic competencies are addressed in a variety of working processes and activities, the acquisition of these competencies is repeated, broadened and deepened over time. However, testing generic competencies appeared to be rather difficult and was only possible by specifying the content of the tasks to be studied. The mistake which was made is that generic competencies were linked to work processes and activities, whereas true competence-based education starts with identifying competencies which are task or problem oriented.

11.7 Research on Competence Frameworks and Competence-based Education

There have been a substantial number of studies on competence frameworks, some of which are reviewed below.

First of all in the field of purchasing, Mulder et al. (2005) developed purchasing profiles for this stratified occupational field. They distinguished several roles in purchasing, such as assistant buyer, buyer, senior buyer and purchasing manager. For each of these roles, a competence framework was composed.

In the field of agricultural extension, Karbasioun et al. (2007) studied the competence profiles of instructors and consultants for integrated rural development (or agricultural and rural extension). The first study was conducted in Iran and the second in Korea.

On communication about HIV/AIDS in agricultural advisory work, Brinkman et al. (2007) developed a competence framework (in the form of competence statements) for rural development professionals in Africa. This project was situated in the international development cooperation context.

On entrepreneurship Mulder et al. (2007), Lans (2009), and Lans et al. (2008a, b, 2010, 2014) studied entrepreneurship competence by defining a competence profile of entrepreneurs in small- and medium-sized enterprises in greenhouse horticulture. They showed that competence assessments can also be used with farmer-owners, who discovered that they possessed competence profiles; that these were related to their performance; that they can be developed; that their co-workers have competence profiles too, which can be developed too; and that they can play an active role in that by transforming jobs into workplace learning practices. Interesting to see is that desired competencies actually possessed by the entrepreneurs are the following (listed from high to low proficiency): organising (highest), problem analysis, leadership, conceptual thinking, persuasiveness, communication, strategic thinking, planning, result orientation, negotiating, teamwork, market orientation, networking, judgement, vision, general awareness, management control, value clarification, personnel management and international orientation (lowest). The study showed that there is a lot of room for competence improvement. Related to this research, Karimi (2014) studied entrepreneurship education in universities in Iran based on the theory of planned behaviour.

Regarding open innovation, Du Chatenier (2009) and Du Chatenier et al. (2009; 2010) have been studying open innovation competence. Open innovation is about the creation of innovations in which professionals of different organisations cooperate. An open innovation is unique in terms of competence as it relies much more on inter-organisational trust and therefore is challenging in terms of intellectual property, knowledge sharing and assuring mutual benefits. The study was conducted by using experts and representatives of open innovation teams in industry. The study resulted in a competence framework of open innovation professionals.

Regarding sustainable development, Wesselink and Wals (2011) developed a competence profile of educators in environmental education organisations. In the field of teacher education, more especially on science teaching, Alake et al. (2014) developed a competence framework of beginning elementary school teachers who are expected to teach science. Amongst other things, she compared the American standards which exist for this with the standards she developed with a group of experts in the Netherlands.

Van der Heide and Mulder (2007) developed an occupational profile for professionals in the field of floriculture in Uganda, in which the floriculture profession was stratified in farm management, departmental management and supervision. This framework was used in curriculum redesign for floriculture at the level of a college and a university (Mulder and Gulikers 2011; Mulder and Kintu 2013). It was used in a subsequent study in Ethiopia and is currently being used in a study in Kenya.

Khaled (2014) studied competence development in practical training provided by a practical training centre in the field of agriculture.

Osagie et al. (2014) studied individual competencies for corporate social responsibility in organisations. Their study proceeds with the question as to what extent notions of the learning organisation (Tjepkema et al. 2002) are related to implementation of principles and policies of corporate social responsibility.

Also, the study of Seuneke et al. (2013) needs to be mentioned, who have analysed the consequences of multifunctional farming for farm household competencies. Their study shows that competencies needed for multifunctionality depend on the strategic choices of the farm owners-managers.

In the field of interdisciplinary work and learning, Spelt et al. (2009, 2015) studied interdisciplinarity competence development by reviewing and implementing educational design rules in food quality management education.

Popov (2013) studied cooperation in international student groups and saw multicultural cooperation competence as a global competence domain (OECD 2016) of utmost importance for mutual understanding, respect and the possibility to effectively cooperate. This study identified important cultural factors that play a role in computer-supported learning in interculturally mixed student groups.

The study of Oonk et al. (2011) is focused on rural development and regional planning issues which are addressed in multi-stakeholder groups, which not only consist of extension workers or researchers but also of representatives of regional authorities or non-governmental organisations (NGOs), university lecturers and students. The groups are learning groups, in which students can do their education projects. This regional learning method is a kind of boundary-crossing hybrid learning arrangement (Cremers et al. 2014) in which education, research, development, entrepreneurship and governance all come together.

Finally, the work of Noroozi (Noroozi et al. 2013a, b, c) is sharply focused on the development of argumentation competence, which is essential in professional practice. He studied this in the theoretical framework of social constructivism and via the analysis of group work on computer-supported collaborative learning platforms.

The formats of the competence frameworks mentioned vary. But a common characteristic is that they all move away from the typical laundry lists of competencies which were created in the 1970s. They tend to be more holistic and avoid overspecification. As competence frameworks they are quite open and flexible.

Research on competence frameworks and competence-based education fits within vocational and professional education research. This was shown in reviews of VET research based on papers presented in the Vocational Education and Training Research Network (VETNET) of the European Conference of Educational Research (ECER) in 2011 in Berlin (Mulder and Roelofs 2012) and 2012 in Cádiz (Mulder and Roelofs 2013), in a number of journals in those years and in the Web of Science in 2012 as indexed by the Social Science Citation Index. A comparison of the 2011 and 2012 reviews on curriculum, learning, instruction and assessment research was presented at the Annual Meeting of the American Educational Research Association in 2014 in Philadelphia (Mulder and Roelofs 2014), in which competence studies were also featured.

11.8 Conclusions

This chapter started with early accounts of the use of the competence concept in education and stated that these served as foundations for the current key competence thinking and alignment theory. It then discussed the concept of competence in relation to the theory of alignment of education and work, especially focusing on competence-based vocational and professional education. The notion that some alignment is necessary in vocational and professional education is not contested anymore, although the development of generic knowledge and skills remains important. For these generic competencies the frameworks of 21st century skills, essential learning outcomes, student outcomes, and global competencies, as described in section 11.5, can be used as a source of inspiration. Vocational and professional education itself needs dedicated competence frameworks. The chapter argued that alignment with competence frameworks is important to guarantee the societal and socio-economic relevance of programmes in vocational and professional education. Without any alignment graduates will not get an adequate starting qualification for the labour market and face difficulties of securing employment and career development. The chapter also argued that institutions for vocational and professional education have the responsibility to evaluate competence frameworks based on their view on the role of education in society. The theory of alignment was therefore extended with two components: competence frameworks and educational philosophy.

The chapter also pointed out that implementation conditions may hamper the quality of competence-based educational programmes. There have been examples that austerity measures such as less instruction, larger classes and over-reliance on self-regulated learning were 'sold' under the then attractive label of competence-based education. However, it can be concluded that when competence-based education means that students will acquire competencies as clusters of knowledge, skills and attitudes and that they will learn to practise these in authentic or simulated authentic contexts, there is no way of making the educational programme cheaper. Including practicums and experience in practice takes ample attention for resources, organisation and commitment.

The chapter positioned competence-based vocational and professional education in the 'integrated occupational' approach, implying a comprehensive view on competence and competence frameworks which serve as the basis for developing and planning a competence-based curriculum, competence-based instruction and authentic assessment.

Furthermore, working with competence-based qualifications frameworks was elaborated, and it was shown that all EU member states now work with national qualifications frameworks (in which competencies are integrated) (Cedefop 2015). Differences in national approaches were highlighted, which are further described in the chapters in part II. Finally, a concise review of research on competence frameworks was presented. Here it can be concluded that more research is needed on the actual implementation and the long-term effects of competence-based educational innovations. This research, however, is difficult because of the long period that goes

by before an educational programme is redesigned using principles of competence-based vocational and professional education, before it is implemented and before the first graduates enter the labour market. Longitudinal studies are needed for this, which measure the activities carried out, practices realised and results achieved by more and less competence-based programmes. This requires monitoring and guided research on curriculum (re-) design, educational implementation and competence assessment in practice.

Finally, it is concluded that no matter what educational theory one appreciates or what principles one follows, both advocates and opponents of competence-based education theory will agree that education should not purposefully develop incompetence Using the expanded alignment approach in vocational and professional education will help to increase the relevance of curricula, sharpen the focus of competence acquisition of students, and strengthen the trustworthiness of competence profiles of graduates.

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Part II
Competence-based Education as a Global Innovation

Chapter 12
Competence-based Education in the United States

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12.1 Introduction

Competence- or competency-based education in the United States has endured throughout the last 60 years, almost in spite of the periodic changes in leadership at the federal and state levels through the electoral process. This chapter provides an overview of the philosophical and practical underpinnings of competency-based education as is developed and expanded over the last century. From the work of philosopher John Dewey and the practical approach to education of Charles Prosser, the US education system has evolved into one of competence assessment and accountability. Major social and political events have had great influence on education and the development of competency-based education. The Industrial Revolution, labor force needs due to involvement in military conflicts, the Cold War, and the threat of being left behind in the space race contributed immensely in determining how changes in education must occur to ensure that the education system responds to the needs of the country and its citizenry. Legislation at federal and state levels continues to strengthen commitment and authority, but the basis for those programs continues to be identifying, delivering, and assessing competency-based education.

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12.2 Foundations for Competency-Based Education

Competency-based education is as old as education itself. In fact, some writers have quipped that no one would ever knowingly plan an educational program that is incompetence based. Formal education in the United States prior to the twentieth century occurred mainly in schools of less than 12th grade, and education beyond high school was often attained only by the wealthy through sending their children to Europe to study the classics, religion, law, or music. The children of the common people developed skills and trades through work in the home, on the farm, or in some small business. While developing competencies that were perhaps enduring, these opportunities were not planned or organized into a schema that provided for the development of competence in a particular skill area.

Much of the educational philosophy underpinnings of the competency-based movement in the United States can probably be traced to John Dewey. Kimpton (1959) wrote of Dewey's early work that became known as progressive education, a term that brought on substantial debate. Nonetheless, as Kimpton reports, Dewey was concerned with the problem of how people think and proposed that all thinking begins with a problem, perplexity, or felt need and ends within a context that shapes thinking and determines the relevance of the conclusion (problem, perplexity resolved, felt need addressed) (Dewey 1997).

Dewey further argued that what is experienced is real (Evans 2000), charting the course for a new look at experience in education and experiential learning. Dewey maintained that all experience is educational but not all education is experiential (Dewey 1897). While on the faculty at the University of Chicago, Dewey developed an experimental elementary school. Children were involved in work and experiences related to such occupations as shop work, cooking and sewing, and gardening (Lakes 1985). Dewey believed that these experiences would help children in developing an understanding of the science and processes of work and to learn to solve problems. Stemming from his belief that the education system needed massive change, Dewey believed that vocational education was the means to bring about that change (Gordon 2008).

During this same time period, Charles Prosser, a graduate of Columbia University and student of David Snedden, served as Deputy Commissioner of Education for the State of Massachusetts and then as Executive Director of the National Society for the Promotion of Industrial Education (NSPIE) (Gordon 2008). The need for better and more extensive occupational training had become evident, primarily as the result of the Industrial Revolution. But unlike Dewey, Charles Prosser promoted the concept that vocational education must combine two facets: practice and thinking about practice and doing and thinking about doing. The main thrust was on the practice and doing, for Prosser believed that learning skills must occur in a situation as close to the reality of the workplace as possible. Prosser's 16 theorems, and his role with the NSPIE, led to his primary participation in writing the National Vocational Education Act of 1917, which was clearly more "vocational" than Dewey would have proposed.

Gordon (2008) summarized Prosser's work and modern times in vocational education by enumerating workplace competencies and foundational skills, emphasizing "school today for skills tomorrow" (p. 28).

Workplace Competencies

Resources: how to allocate time, money, materials, space, and staff
Interpersonal skills: how to work on teams, teach others, serve customers, lead, negotiate, and work well with people from diverse cultural backgrounds
Information: how to acquire and evaluate data, organize and maintain files, interpret and communicate, and use computers to process information
Systems: understand social, organizational, and technological systems; how to monitor and correct performance; know how to design or improve systems
Technology: how to select equipment and tools, apply techniques to specific tasks, and maintain and troubleshoot equipment

Foundational Skills

Basic skills: reading, writing, arithmetic, mathematics, speaking, and listening
Thinking skills: ability to learn, to reason, to think creatively, to make decisions, and to solve problems
Personal qualities: individual responsibilities, self-esteem and self-management, sociability, and integrity (p. 28)

Those competencies and skills could serve as the basis for modern-day competency-based education.

Vocational education, however, whether under the philosophy of Dewey or Prosser, is not necessarily competency-based education. With the advent of a dual system of education that separated "academic" and "vocational" education, as Prosser proposed, one of Dewey's major concerns surfaced (Gordon 2008). Dewey argued that separating trade education from general education would tend to make both forms narrower, less significant, and less effective (Dewey 1915).

In summary, Prosser clearly advocated job-skill development which can be viewed as a precursor to the competency-based education movement. Dewey worried that such education would lead to the status quo, limiting rather than transforming industrial society.

12.3 Behaviorism and Competence

The concepts and practices of competency-based education and training in the United States are deeply rooted on the theory of behaviorism. Since behaviorism focuses on the measurable activities of the learner, education and training following the behavioristic model means bringing about a change in behavior. Therefore, the way to understand humans is through observing their behavior (Wang 2011).

Behaviorism is not anti-Dewey in philosophy, since Dewey believed that experiences drive education. Further, various writings by B. F. Skinner (1968)

emphasized that learner behavior can be directed and redirected and can be controlled through positive reinforcement and individual differences can be addressed.

Behaviorism in the context of competency-based education and assessment relies on three components. These include:

1. The conditions under which the activity is to be performed
2. The behavior that is to be performed
3. The criteria by which the behavior will be evaluated as acceptable/unacceptable or successful/unsuccessful (Wang 2011)

The goal in behaviorism is to assess the learning outcomes as objectively and accurately as possible in order to show how much progress is being made and, perhaps, what additional learning needs to occur.

Ellias and Merriam (2005) indicated several advantages of applying behavioristic principles to occupational learning. They include:

1. Allowing for individual differences in terms of starting points for instruction
2. Providing flexible time in allowing students to achieve mastery
3. Learning in a variety of conditions and settings
4. Using criterion-referenced rather than norm-referenced assessments
5. Encouraging self-direction for individual experiences

Of course, as in any approach to teaching, learning, and training, the authors also admit to some potential disadvantages:

1. The behavioristic approach requires accurate identification of tasks to be completed.
2. Some competencies may be difficult to specify and therefore difficult to perform and assess.
3. Minimum performance standards for assessment of learning may be difficult to establish.
4. The end product is predetermined, perhaps limiting creativity.
5. The curriculum may become fragmented.

But despite both advantages and disadvantages, behaviorism has provided a solid theoretical background for competency-based education.

Benjamin Bloom (1956) with colleagues at the University of Chicago defined and expanded upon work of earlier education philosophers in describing the cognitive domain of learning. Bloom's work, although occasionally "updated" by more recent authors, has stood the test of time in establishing a framework for behavioristic cognition. In the cognitive domain, six levels of hierarchy have been established to show increasingly complex but not necessarily increasingly important levels of behavior: knowledge, comprehension, application, analysis, synthesis, and evaluation. The work of Bloom is frequently associated with writing instructional objectives that include the essential components as defined by Skinner (1968): conditions, performance, and criteria.

Later, Mager (1984) continued the work of Bloom in providing guidance for writing instructional objectives in a behaviorist mode. His work is credited with promoting behavioral objectives in education and training.

Behaviorism centers on learner activity that can be seen, practiced, and assessed. Although the term competence came into vogue later, it can be observed that the works in behaviorism served as a basis for competency development and competency-based educational practice. The theory of behaviorism was a strong influence on the development of competency-based education, with the emphasis on expressing competencies in behavioral terms and on assessment of observable behaviors (Hodge 2007).

Hodge also discussed systems theory as a basis for the development of competency-based education. First, training is seen as a subsystem to the broader complex such as industry. As a corollary, training can be viewed as an independent or individual system, leading to what can be construed as the ideal model for training (Hodge 2007).

Behaviorism and competence development has also been linked to behavior modification. While Skinner (1968) used that term more narrowly, more recent uses are more positive in approach. Behavior modification is a method of eliciting better classroom performance from reluctant students. It has six basic components:

1. Specification of the desired outcome (what must be changed and how it will be evaluated)
2. Development of a positive, nurturing environment (by removing negative stimuli from the learning environment)
3. Identification and use of appropriate intrinsic and extrinsic rewards
4. Reinforcement of behavior patterns that develop until the student has established a pattern of success in engaging in class discussions
5. Reduction in the frequency of rewards—a gradual decrease in the amount of one-on-one review with the student before class discussion
6. Evaluation and assessment of the effectiveness of the approach based on teacher expectations and student results (Brewer et al. 2000)

Taken literally, behavior modification takes on an aura of negativity. A criticism of behaviorism is that student creativity is stifled and that teaching is too instructor focused. Newer "theories" such as constructivism appear to address those concerns; however, it should be noted that the end result of a constructivist approach to teaching, for example, is still behavior change. The learner, as a result of successfully developing competence, can do, think, and appreciate a phenomenon differently. Behavior was changed.

12.4 US Education Movements in the Twentieth Century

Early in the twentieth century, the US populace was faced with the need to address issues in public education (Calhoun and Finch 1976). Rapid developments in industry, the need to feed more people, and the migration from rural to urban areas called for a transformation in thinking and practice regarding public education. As schools developed (expanding to include high schools and firmly establishing public universities), citizens were torn between keeping the federal government out of local

concerns and wanting the federal government to provide a high-quality education, or at least an opportunity for such, for all citizens. Secondary school education was not mandatory, there was little motivation for children to remain in school, and therefore little was being done to help children learn necessary skills required to be successful in the agro-industrial complex. Such a failure of schools led to a substantially unproductive and underproductive society (Calhoun and Finch 1976).

The National Society for the Promotion of Industrial Education (NSPIE), which Charles Prosser helped found, was essentially created to address the issues of education in an Industrial Revolution United States (Barlow 1974). The Society was successful in encouraging the federal government to establish the Commission on Vocational Education in 1914, with the purpose of creating a report on the status of vocational education (Hawkins et al. 1966). Prosser was also instrumental in crafting early legislation regarding vocational education, and the NSPIE later became the American Vocational Association and now the Association for Career and Technical Education.

The movement toward education related to industries and toward skill development grew during the early twentieth century as a result of various societies and commissions in the states. Manual training in agriculture and home economics had been introduced into many schools, but instruction lacked a vocational or competency focus (True 1929). The demand for a more definitive type of industrial education arose, and the movement evolved into the broader arena of industrial education.

Legislation that authorized and appropriated funds for vocational education and training had been proposed in various forms, but eventually the US Congress passed and President Woodrow Wilson signed the National Vocational Education Act of 1917, more commonly referred to as the Smith-Hughes Act (proposed by Senator Smith and Representative Hughes of the State of Georgia). The Act provided for instruction in agriculture, home economics, and trades and industries, called for a federal board for planning and oversight, and provided for state-level leadership and teacher preparation (True 1929).

Additional legislation by the US Congress addressed specific aspects of the initial 1917 legislation. But the major tenets of the creation of vocational and technical education endured for decades and served as a grounding point for later developments in competency-based education.

12.5 War, Recession, the Military, and Sputnik

The involvement in World War I by the United States created immediate demand for trained workers in a broad array of industries. Supplying the military with mechanics and technicians required quick and intensive training. In addition, with millions of men leaving work to serve their country, additional demand was placed on other industries to fill the void. All of this had an enormous impact on training, and the US government and people began to develop a better and stronger appreciation for technical training (Thompson 1973).

Dominant among social issues related to workforce development was the Great Depression, extending from late 1929 through most of the 1930s, with a large effect on youth employment as well as adult's. Enormous unemployment rates meant that employers could hire experienced adults rather than youth who had no training and no work experience (Evans 1971). As a result, the federal government passed legislation to address the training needs of youth. Programs such as the National Youth Administration and the Civilian Conservation Corps helped unemployed young men prepare for and find suitable employment (Calhoun and Finch 1976).

World War II created even more pressure on the workforce in the United States and on training programs, both within and outside of the military. By then, vocational training was much more prevalent, and the government could concentrate more on expanding existing programs rather than creating and funding new programs (Thompson 1973). Likewise, military and industrial needs were more defined as a result of the growth and expansion of industrial technology, so the concept of training a worker for a specific set of observable and measurable skills was becoming commonplace.

Jobs were plentiful during the period of US involvement in World War II, and the demand for well-trained workers was enormous. But the aftermath of the war created an even greater challenge for employment and training. Military personnel returning from the war needed jobs and needed training (Thompson 1973). While many chose to enter or return to higher education, many thousands of others needed a job and did not have the time or the money to spend months or years in preparing for the workforce.

The Cold War period of the 1950s and 1960s, with tensions between the United States and the former USSR, created a demand for more of a systems approach to skill training (Hodge 2007). War had created a need to specific and usually short-term training for becoming competent in a specific set of tasks. The postwar emphasis shifted to viewing skill development within larger and more complex systems calling for the interface between man and machine, with human development as one component of the larger system. Thus, competency training could be subdivided into the separate and specific problems as identified by Kennedy (1962): individual training, environmental supports, team training, and system training. The Manpower Development and Training Act of 1962 further recognized the need for fiscal programs that are geographically selective to help maintain national economic activity (Bachmura 1963). The legislation authorized programs for people whose skills were rendered obsolete and for new entrants to the workforce who needed further education to meet employment needs.

The launch of Sputnik in 1957 prompted a much stronger federal role in education. The fear that the USSR was outpacing the United States academically created a fury of legislation in order to help ensure the security of the nation (Elam 1971). Two decades of federal intervention led to massive increases in funding and subsequent legislation including the Vocational Education Act in 1963 and the Elementary and Secondary Education Act of 1965. Indirectly, all of this activity gave economic support to the development of competency-based education.

12.6 Outcome-based Education

The outcome-based education (OBE) movement was promoted as a model for restructuring education, moving the measurement of education progress from inputs to outcomes. Spady (1988) is often credited with being a developer and certainly an advocate of OBE, arguing that the traditional approach to education favored administrative convenience over student mastery (McNeir 1993). He also noted that OBE is prevalent throughout the world in a variety of models, dating back to the craft guilds of the Middle Ages. Spady (1994) defined OBE as a comprehensive approach to organizing and operating education systems focused on successful demonstrations of learning. Outcomes are learning results for students to demonstrate and performances that reflect learner competence in using what they have learned. Spady argued that OBE must be based on four principles:

1. Clarity of focus on outcomes of significance, making sure to continuously align instruction and assessments with the desired end state
2. Designing down from the ultimate outcomes, working back from the desired end state and establishing the resources and skills needed to achieve the desired state
3. High expectations for high levels of success, achieving a greater level of success for each student and eliminating the idea that some students cannot achieve that success
4. Expanded opportunities and support, recognizing that time is the most critical resource that enables students to achieve goals rather than a constraint on educational process (Gardner 1983)

Advocates of OBE generally agreed that standards and expectations will rise because the emphasis focuses on the learner and what can be achieved.

Spellings (2008) consolidated the thinking of OBE scholars in a comparison of what was termed the "traditional education model" and the outcome-based or "transformational" model.

Traditional education model	Outcome-based model (Transformational model)
Inputs such as number of books and computers available, student/teacher ration	Engender the competent citizen prepared for the challenges of the future
Courses academically structured and designed around hours available to teach	The outcome or result is most important
All students move through the subject material as a cohort group at the same pace	Outcomes are developed first; the course is structured with flexible time, resources, and space
Teachers are given specific subjects they prepare for and teach and then evaluate students	Learners move through the subject material at their own pace using methods that suit their style
Evaluation criteria are based on tests and/or papers graded by the teacher	Teachers have a holistic role, responsible for outcomes related to the course
Learners amass enough classes over a specific period of time, leading to a credential awarded by a governing body	Learners demonstrate mastery of material through practical application such as projects, products, and performances

Spady (1988) further dichotomized traditional methods and OBE, indicating that traditional methods are ineffective and perhaps detrimental to learning. A teacher covers a given amount of content in a given amount of time and then assumes that learning has occurred. When time is the constant, learning becomes the variable.

McNeir (1993) recognized that implementing OBE in school settings (and probably in the industry as well) is challenging and requires change throughout the system. Her observation was that OBE often was not fully implemented into a systems approach to reform, but rather the OBE philosophy was merely superimposed onto an existing curriculum and school goals dictated by legislative requirements. Further, additional challenges are presented once OBE is implemented, including the difficulty in writing exit outcomes, balancing OBE process with content, and creating new methods of assessing learning.

Where complete implementation of OBE has occurred in school systems, the challenges have been addressed. Fitzpatrick (1991) described the work in one school district that adopted OBE. The first step was to envision the skills and knowledge needed by students, leading to proposed outcomes:

- Ability to communicate
- Facility in social interaction
- Analytic capabilities
- Problem-solving skills
- Skill in making judgments and decisions
- Skill in creative expression and response to creative work of others
- Civic responsibility
- Responsible participation in a global environment
- Skill in developing and maintaining wellness
- Skill in using technology
- Skill in life and career planning

Based on these proposed outcomes, the curriculum framework was created with flexibility in which credits and the number of courses vary with students. As a result, students should be able to demonstrate the ability to:

- Employ observation skills
- Classify and organize information
- Draw and support inferences
- Describe and define relationships
- Integrate and apply these skills in a variety of situations (Fitzpatrick 1991)

More recent work in instructional design labels the process “backward design” or beginning with the end in mind (Wiggins and McTighe 2006). While the term “backwash effect” may also be used, that process is often associated with “teaching to the test” which has negative connotations in an era of standardized testing. Backward design, according to Wiggins and McTighe, is more closely associated with identifying outcomes and competencies to be achieved or developed and then creating a learning environment to bring about success in competency development. Those authors promote the concept that the three steps in instructional design

include identifying desired results, determining acceptable evidence, and planning learning experiences and instruction.

Outcome-based education, then, is clearly rooted in the philosophy and practice of noted education leaders. Tyler (1949) identified the fundamental issues of developing and planning instruction, including purpose, content, organization, and evaluation. He firmly believed that objectives were essential for systematic planning and identifying desired learner outcomes. His work coupled with the taxonomy of educational objectives prescribed by Bloom (1956), discussed earlier in this chapter. And the concept that learner outcomes are more than a simple skill development (although technical skills are important) derives from the Dewey philosophy combined with the pragmatic approach of Prosser.

Of course, there were and are detractors. McKernan (1993) began with questioning the underlying assumptions of OBE, asserting that teaching with a specific outcome in mind contradicts the notion that education is an induction into knowledge and denies the possibility that the education experience (acquiring knowledge) is valuable in and of itself. He further raised concerns that OBE mirrors behavioral modification, and stating specific outcomes implies that external testing is the only way to determine whether those objectives have been met.

McKernan offers his own alternative to OBE, a "procedural inquiry model" which contains three components. First is the broad aim of advancing understanding. The second is based on the assertion that discussion is the best teaching strategy for meeting this aim and the teacher is a facilitator who remains neutral on values issues. And third, the model includes criteria for assessing performance, including how well learners use concepts and knowledge to explore new ideas. Reflection on McKernan's discussion and model provides insight regarding how his objections and proposed model probably fit well into Spelling's (2008) transformational model, actually not differing significantly from the rich underpinnings of OBE.

The move toward outcome-based education was in part in response to concerns that the US education system cannot adequately prepare students for life and work in the twenty-first century (Education Commission of the States (ECS) 1995). Educators and policy makers in several states have attempted to change the way education effectiveness is measured from an emphasis on traditional inputs, such as course credits earned and hours spent in class, to results or outcomes. Further, a competency-based education system also takes into account the student's prior learning, although that premise is not widely accepted in higher education (Harris et al. 2011). This change mirrors the total quality movement in business and manufacturing and reflects a belief that the best way for individuals and organizations to get where they want to go is first to determine where they are and where they want to be and then plan backward to determine the best way to get from here to there.

Proponents of OBE assume there are many ways to arrive at the same results; the important thing is that states, districts, schools, and students do achieve them. Opponents worry about who will decide on outcomes and how students, schools,

and districts will be held accountable for achieving them. Both sides raise fundamental questions about the structure and direction of the education system and the role of education in a democracy (ECS 1995).

Debate about OBE reveals widespread confusion about terminology and concepts. The term "outcomes," "standards," and "goals" frequently are used interchangeably, and individuals disagree about their meanings and applications. And those terms are used interchangeably to refer to different types of results, including content outcomes, student performance outcomes, and school performance standards. *Content outcomes* describe what students should know and be able to do in particular subject areas. *Student performance outcomes* describe how and at what level students must demonstrate such knowledge and skills. *School performance standards* define the quality of education schools must provide in order for students to meet content and/or performance outcomes (ECS 1995).

The 1995 report from the ECS also provided an overview of arguments in favor of and against OBE.

Common arguments in favor of OBE	Common arguments against OBE
Promotes high expectations and greater learning for all students	Conflicts with admission requirements and practices of most colleges, which rely on credit hours and standardized test scores
Prepares students for life and work in the twenty-first century	Some outcomes focus too much on feelings, values, attitudes, and beliefs and not enough on attainment of factual knowledge
Fosters more authentic forms of assessment	Relies on subjective evaluation rather than objective tests and measurements
Encourages decision-making regarding curriculum, teaching methods, school structure, and management	Undermines local control

Coinciding with outcome-based education, occupational analysis stems from determining the one best way to do a job. Occupational analysis begins with task analysis, including procedural tasks and information processing tasks. Procedural task analysis involves breaking tasks into steps or procedures that workers perform to complete the task (Wang 2011). Procedural task analysis is driven by the philosophy of behaviorism, focusing on observable and measurable behaviors. Similarly, information processing tasks account for the intellectual skills that are requisite in completing the work. Occupational analysis leads to competency-based education and training.

Outcome-based education can be regarded as a theory or philosophy of education (Killen 2000). That theory provides a set of beliefs and assumptions about learning, about teaching, and about systemic structures to form a basis for outcome-based and competency-based education.

12.7 Competency-Based Education

Competency-based education (CBE) was introduced in the United States in the 1960s in reaction to public concern that students were not being taught the skills needed for success in life, in reaction to international issues on competition including the "space race" after Sputnik, and in addressing legislation at the federal and state levels as noted earlier. Public dissatisfaction with schools and the public perception of teacher incompetence were driving forces (Ross 1982; Rossner and Kay 1974). Rossner and Kay further contended that CBE resulted also from demands for accountability, relevance, and cost-effective schooling. A CBE approach was seen by many educators as a means to satisfy the demand for accountability in the schools. Various authors asserted that CBE would assure that students would learn the skills needed to become successful members of the workforce and society, that students would learn more and at a faster rate, and that CBE was inexpensive to implement (Rockler 1979; Allen 1981; McGowan 1981; Vincent and Cobb 1977).

Norton et al. (1978) also pointed out an important stimulus for the development of CBE in the US dropout rates in secondary schools, and difficulties in finding jobs for graduates in the 1960s led to the creation of a national panel to review vocational education legislation and programs. The report led to the Vocational Education Act in 1963, mentioned earlier, which altered the concept of work and funded the development of job training institutions. Obviously, these actions had significant impact on the preparation of teachers to work in environments that could lead to greater successes in competency-based programs.

A variety of definitions exist for CBE. Most models include these elements:

- Performance based.
- Responsive to individual needs.
- Flexible timeframe to achieve mastery.
- Provisions for immediate feedback.
- Based upon task analyses.
- Containing measurable objectives.
- Variety of instructional activities.
- Explicit learning outcomes.
- Criterion-referenced assessment.
- The learner is accountable for personal achievement (Buttram, Kershner, Rioux, and Dusewicz 1985; Malan 2000).

More recently, Wesselink et al. (2007) reported eight principles of competence-based education derived from a focus group and Delphi study involving Dutch researchers. The eight principles include (see the chapter of Wesselink et al. (Chap. 25) in this volume for an elaboration of these principles):

- Competencies that are the basis for the study program are defined.
- Vocational core problems are the organizing unit for designing the curriculum.
- Competence development of students is assessed before, during, and after the learning process.

- Learning activities take place in different authentic situations.
- In learning and assessment processes, knowledge, skills, and attitudes are integrated.
- Self-responsibility and self-reflection of students are stimulated.
- Teachers in both school and practice fulfill their role as coach and expert in balance.
- A basis is realized for a lifelong learning attitude for students.

Competency-based education in the United States also correlates with the mastery learning movement (Soares 2012). A model of mastery learning was first theorized by Carroll (1963). His concern was that the current system of instruction nurtured the achievement of only a small number of students. In order to improve effectiveness, Carroll developed his model of school learning, a mathematical-oriented model that asserts that a learner will succeed in learning to the extent the learner spends the time needed to learn the task. Factors associated with the model included the learner (aptitude, time needed to learn under ideal instruction, ability to understand instruction, perseverance) and external conditions (time allowed for learning, quality of instruction). Achievement could be traced to the combination of these conditions, so maximizing time allowed and improving instruction would address individual needs and result in higher rates of success.

Logically, mastery learning should be the basis for all of education. However, in a highly structured system, whether in schools or industry, time is not flexible. Improvements in instruction, assuming that attention is given to assessing needs and providing development of techniques, cannot be totally accountable for improvement in student learning. Mastery learning addresses the key concepts of competency-based education; administrators need to make an effort to solve the "flexible time" component.

Two additional issues must be discussed regarding the advent of CBE in the United States. Those are assessment and accountability, which are highly interwoven.

Glaser (1962; 1994) provided much-needed guidance in terms of assessment measures for training programs and other competency-based programs. Norm-referenced assessments are those that measure a student's performance against the performance of other students. Such an assessment provides information about how the student compares to the norm but does little to reflect how the student performed in relation to the content to be learned. Norm-referenced measures can say a lot about a group but very little about an individual; individual student assessment is based on relativity, which is hardly relevant in the real world. However, norm-referenced assessments are the basis for standardized tests including state-mandated assessment tests and college entrance tests.

Criterion-referenced assessments indicate whether the student has learned the behaviors as identified in the curriculum and objectives. A concern is that the assessment could evolve into "yes or no" regarding whether the learner has achieved the desirable behavior. Various methods are used to address the concern, primarily that

of establishing a minimum level of accomplishment (such as 90 % accuracy) for declaring competence (Malan 2000).

For trainers and instructional designers, criterion-referenced assessments can provide valuable insight into the success of a given education/training program and help chart the course for additional development activities.

In the United States, competency-based education has been embraced more by human resources departments (staff development, personnel management and training) and in adult education than in the school system. Several factors are associated with those differences.

First, industry has much greater flexibility in designing and offering CBE programs for employees. Further, industry can require participation (and passing scores) of employees as a requirement for continued employment and advancement. Human resources can offer programs for any amount of time, and employees can be given the flexibility to spend the time necessary to master the content, practice the new behaviors, and show competence to supervisors. The military model is perhaps the most evident. Competency-based training is provided for a select set of enrollees who study and practice a finite set of skills until the required level of achievement is reached. To the extreme, no one would want military personnel protecting the country with only partial knowledge because the trainees ran out of time before learning the skills.

Adult education, such as through the federally and state-funded cooperative extension service and community colleges, is also a prime location for CBE. Adult learners are more mature, are clearer in identifying their needs, and are willing to spend adequate time (but no more, in most cases) in achieving their learning goals. Their interest in obtaining mastery rather than a grade adds to their ability to achieve in a CBE setting.

Within a school classroom or within a unit of instruction within a class, CBE can be highly effective through taking advantage of opportunities for flexible learning time. Especially in primary grades, students are already grouped by ability level. As they are provided content to be mastered, each group and each student within a group can progress at a unique rate. Once a skill is mastered or a behavior is successfully demonstrated, the learner can progress to the next level.

Why is CBE not fully integrated into the academic setting? The answer is relatively simple. The US education system is still based on an agrarian society where the children needed to be released from school in the summer to help on the farm. The 9-month school year mentality is still pervasive. Likewise, the 13-year system is based on groups of students progressing from one grade level to the next after about 36 weeks of instruction, regardless of whether any or all of the students achieved full mastery of the content. A passing grade is license to pass to the next grade level. And in higher education, achievement is measured more by “seat time” than by development and mastery of competence (CIC 2015), which is measured by credit hours. However, educators continue to emphasize student learning outcomes as intended measures of competence (Klein-Collins 2013). Competency-based

education in higher education seems to be more popular among older, place-bound students with significant work experience, probably related to online programs being focused more on competency development approaches (Kelchen 2015; Klein-Collins 2012).

More recent legislation such as *No Child Left Behind* (USDE 2002), *Race to the Top* (USDE 2009), and *Every Student Succeeds* (USDE, 2015), which are actually extensions of the Elementary and Secondary Education Act, purportedly address accountability. Schools must be able to show how students are achieving at rates acceptable to a set of standards. The Common Core (USDE 2009) movement, at federal and state levels, is also designed to ensure accountability that schools are doing what they are funded to do and that therefore students are learning what they are supposed to learn. However, the utilization of high-stakes testing to decide whether schools and learners are achieving the intended outcomes has proven to be less than adequate and less than ideal. It could be concluded, then, that if competency-based education were fully implemented in the public school system, embracing all of the elements in a CBE model, students would learn more and schools would be more accountable.

In the United States, career and technical education address CBE more closely than any other facet of the school system. A modern-day derivative of vocational education, career, and technical education embraces the tenets of competency-based education. The combination of classroom instruction in academic and technical areas with hands-on activities in laboratories and on-the-job training provides opportunity to address the behaviors identified through occupational analysis for all students and in all academic and technical areas.

12.8 Conclusions

Competency-based education is alive and well in the United States. Reauthorization of legislation such as the Elementary and Secondary Education Act on a periodic basis, especially during changes in federal administration, continues to address how the public school system can plan for and meet the needs of all students. The debate continues regarding whether CBE is the right response; nevertheless, federal and state programs continue to authorize, mandate, and to some extent fund the careful analysis of what skills and competencies are needed and how student progress should be assessed.

After 100 years, the philosophy of Dewey in terms of educating the "whole person," coupled with the work of others such as Prosser, who viewed competency development more narrowly, continues to be the basis for public education. While the mandates and restrictions are considerably less at the post-high school levels, even higher education continues to grapple with identifying the competencies needed for graduates to be successful and to be productive workers and citizens.

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Chapter 13
Competence-based Education and Assessment in the Accounting Profession in Canada and the USA

J. Efrim Boritz and Carla Carnaghan

13.1 Introduction

In Chap. 12 Barrick described the origins of competence-based education in the United States of America (USA). This chapter describes the developments in competence-based education in recent years in Canada and the USA, using the accounting profession as an example. Other examples of recent developments in competence-based education are provided by Ten Cate in his chapter on the medical profession's use of this approach. The accounting profession in both countries has adopted the competence approach for such purposes as certification, informing educators and, in some cases, for professional education programs. However, diverse practices have developed, depending on each professional accounting body's (PAB) goals.

As suggested by Mulder and Winterton in Chap. 1, a competence-based focus means the professional associations such as the PABs define professional qualifications in terms of outcomes or what an individual can accomplish rather than solely in terms of knowledge or other isolated attributes possessed by the individual.

Arguments for using competence-based models in accounting have included: improving the link between formal education and job performance, attracting more people to the accounting profession, helping students understand what they need to be able to do (Hamilton 1999), guiding accountants as to what they need to be able to do at various stages in their careers (Fontaine 2012), and self-assessing proficiency to determine where further professional development is needed (Voghel 2000). Given these many potential benefits, competence-based approaches have

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seemed like a panacea for many of the problems of linking educational goals and professional practice, though evidence concerning the efficacy of the approach has been lacking.

This chapter starts with a review of the recent developments of competence-based approaches in the USA and Canada, using the accountancy profession as an example. Current accountancy competence frameworks in use in the USA and Canada are then discussed and comparisons are drawn to international accounting education standards, addressing competencies and outcome-based learning. The current competence-based approaches are then characterized based on the attributes of each approach, followed by the identification of some strengths and weaknesses of competence-based practices in accounting. Current efforts in accounting are then compared with what is happening in the medical profession, and possible future directions for competence-based approaches in accounting are discussed. The chapter concludes by summarizing the key points from this review.

13.2 History of Competence-based Approaches in the Accounting Professions in Canada

Canada's three professional accounting bodies and their successor organization used similar models for certification. The general model normally requires candidates to have a university degree and appropriate accounting and other business courses. Each body then requires candidates to take its own professional education program and gain appropriate work experience, with exams throughout the professional program and some sort of culminating capstone exam or activity. Further professional development activities were then required by all of the bodies to maintain the designation. The three predecessor accounting organizations began exploring competence-based approaches to accounting certification and professional education for candidates during the 1990s and early 2000s.

13.2.1 Certified General Accountants Canada

Jetalina (1999) states the interest of the Canadian professional association "Certified General Accountants (CGA) Canada" in competence-based models began with the establishment of a taskforce in 1998 to examine competence-based models globally. She noted that the interest in such models by the accounting profession was related to the perceived need to develop accountants with skills that went beyond accounting. The initial model CGA Canada developed was intended to be used by established Certified General Accountants (CGAs) to help them to determine the need for additional professional development in their current role. This model also had templates for common roles of CGAs that helped users identify the required competencies and levels of proficiency needed.

Harrison (2004) notes that CGA Canada later implemented competence-based education in the CGA professional development program as well as for certification. Significant revisions were made to the competence model based on a practice analysis using survey results from 2500 CGAs. In 2004, there were four groups of competencies, comprising 147 competencies and 176 knowledge topics. The two final capstone courses had competence-based exams that were case-based to simulate a work-related professional accounting situation.

13.2.2 Canadian Institute of Chartered Accountants

The Canadian Institute of Chartered Accountants (CICA) also developed competence frameworks, or maps; the first one was published in September 2001, based on consultations with academics and professionals. A key impetus for this adoption came from a CICA task force report that indicated competence-based education would be the key to achieving the CICA's new vision and mission (CICA 2002). The CICA implemented a competence-based approach for certification in 2003. The final competence map was "The UFE Candidates' Competency Map" produced by the CICA (2013). This competency map noted that it was used for several purposes: to develop the culminating professional exam (the Uniform Final Exam or UFE), to ensure that universities provided appropriate curriculum content, to help employers assess the appropriateness of candidates' practical experience, and to enable the CICA to determine the nature and content of the professional education program.

The 2013 CA Competency Map divided competencies intro three categories: pervasive qualities and skills (soft skills and personal attributes expected to be used in all situations), specific competencies (technical skills across six areas), and the underlying knowledge references. Three levels of proficiency were specified ranging from the ability to describe a particular skill to the ability to successfully complete it individually.

13.2.3 The Society of Management Accountants of Canada (SMAC)

The Society of Management Accountants of Canada (SMAC) released their competence map in 2005 (SMAC 2005), with competencies identified as being either functional (technical knowledge) or enabling (soft skills and attributes). The map was intended to be the key to professional education and certification. The competence map was revised in 2011 (SMAC 2011), with roughly 100 functional and enabling competencies spanning the three key dimensions of accounting, management, and strategy, and with each of these dimensions having competencies related to creating,

preserving, enabling, and reporting value to achieve sustainable organizations. There were three levels of proficiency. The map was now also intended to help CMAs understand professional development needs throughout their careers. The revisions were based on input from the practitioners and academic communities, as well as direction provided by the International Federation of Accountants (IFAC) (Benn 2011).

13.2.4 CPA Canada

With the merger of the three accounting bodies in Canada to form CPA Canada between 2012 and 2014, a new competence map was created in 2012 to help unify the three bodies' professional programs and certification requirements. Fontaine and Gulens (2013) describe the map as having been developed by education experts in conjunction with accounting academics, practitioners and employers. More details on the CPA Canada approach to competence will be given in the next section.

13.2.5 American Institute of Certified Public Accountants

The American Institute of Certified Public Accountants (AICPA) has a different approach to certification than Canadian accounting bodies, with specific education and licensing requirements determined by 55 state boards (AICPA 2016). All US states require 150 semester hours, which in essence comprise 50 semester long courses. This would typically take five years of education, which can be satisfied by a four-year undergraduate degree and a one-year Master's program in Accounting, or additional courses. The CPA Uniform Exam is the same across all states, with a prespecified passing score of 75 on a 0–99 scale. State Boards determine what the requirements are to take the exam, such as the amount of relevant work experience needed. The AICPA does not provide its own professional education program.

According to Abbasi (2013), the AICPA has had a Core Competency Framework since 1999. Bolt-Lee and Foster (2003) note that the Framework was developed by academics, state accreditation bodies, and practitioners in response to the AICPA CPA Vision document of 1998 to help educators and students understand what was needed to become a successful professional. The Framework makes no attempt to identify specific accounting competencies. Instead, it identifies at a fairly high level of about 20 functional, personal, and broad business perspective-related skills. According to its developers, "A skills-based curriculum is advocated, because the body of knowledge and the accounting profession are changing so rapidly… the core set of competencies identified by the Framework will have long-term value and will support a variety of career opportunities for the future CPA" (AICPA 1999).

The resulting document is thus quite short compared to Canadian accounting competence maps. While the AICPA notes that the Framework identifies the skills needed by successful CPAs, it does not claim to have built its common exam around the framework. However, the AICPA did develop a document mapping the core competencies to what is tested on the CPA exam. Further details on the AICPA Competency Framework will be provided in the next section.

13.2.6 Joint AICPA and Chartered Institute of Management Accountants Initiative

In 2014, the AICPA and the Chartered Institute of Management Accountants (CIMA) jointly developed a competence-based education framework for a Chartered Global Management Accountant (CGMA). The CGMA Competency Framework was developed through face-to-face interviews, roundtables, and an online survey of nearly 3400 CIMA members, students, and academics. (CGMA 2015a).

The framework is explicitly described as providing the foundation for the CIMA syllabus and certification exam, as well as helping employers and educators understand what is expected. More details on the CGMA framework will be provided in the next section.

13.2.7 Definitions of Competency Used in the Accounting Competence Frameworks

Definitions of a "competency" have not always been provided with the competence maps and frameworks but when provided are somewhat similar. For example, the Competency Framework of the Certified General Accountants Canada defined a competency as "a specific behavior whereby a professional applies knowledge, skills, and or/professional values in a work environment; the behavior can be defined, demonstrated, observed, and assessed" (CGAC 2010: 10). The Certified General Accountants Canada chose to define competence in a similar way as IFAC in 2008. This definition is also similar to the definition of competence provided by Mulder and Winterton (2016) in Chap. 1. The 2013 CA Competency Map of the Canadian Institute of Chartered Accountants defines competence as "the broad range of knowledge, skills, attitudes, and observable behavior that together account for the ability to deliver a specified professional service" (p. 11), while a competency is "the particular tasks that CAs perform while applying, or bring to bear, the pervasive qualities and skills that are characteristic of CAs to the level of proficiency defined as appropriate by the profession." (CICA 2013: 11). The current CPA Canada competence map does not provide a definition of competence but implies that competencies are based on skills and abilities. The Chartered Global Management Accountant FAQ document refers to the map as specifying the knowledge and skills required.

13.3 Current Competence-based Approaches in Accounting

In this section, competence-based approaches for education and accreditation of accountants in the USA and Canada are reviewed. As noted earlier, the two frameworks which were developed and used by the American Institute of Certified Public Accountants are quite different from each other: one for CPAs (Certified Public Accountants) and another one for CGMAs (Chartered Global Management Accountants). In Canada, CPA Canada has a single competence-based model for CPAs (Chartered Professional Accountants) despite the fact that it is the successor organization to three different legacy bodies with different areas of focus prior to their merger.

In the next section, the accountancy competence frameworks used in the USA and Canada will be elaborated. Where original frameworks are mentioned, the original spelling of these frameworks will be used.

13.3.1 United States of America

Both frameworks, for public and management accountancy, will be described here.

13.3.1.1 CPA—Certified Public Accountants

The CPA Core Competency Framework identifies functional, personal, and business perspective categories.

- Six core functional competencies are identified: Decision Modeling, Leverage Technology, Measurement, Reporting, Research, and Risk Analysis.
- Seven personal competencies are identified: Communication, Interaction, Leadership, Leverage Technology, Problem Solving/Decision-Making, and Professional Demeanor.
- Seven broad business perspectives are identified: Industry/Sector Perspective, International/Global Perspective, Legal/Regulatory Perspective, Leverage Technology, Marketing/Client Perspective, Resource Management, and Strategic/Critical Thinking.

These 20 competencies are considered universally applicable to a diverse and expanding set of accounting career options. For each category a number of skills and/or attributes are identified. However, although the underlying competency definition appears to consider both skills and personal attributes as competencies, there is no explicit role for knowledge, in the sense that accounting-specific skills related to audit, tax, financial reporting, etc. are not identified.

Competencies are also regarded as the skills themselves rather than outcomes from applying the skills. In this regard, the model is not consistent with the 2015

model based on learning outcomes that is currently being advocated by the International Accounting Education Standards Board (IAESB) of IFAC. A learning outcomes approach focuses on an individual's demonstrated achievement of the learning outcomes at the specified level of proficiency and not on the learning process.

The AICPA's approach appears to take a holistic view of competencies. To be flexible, course listings are not prescribed and competencies are not ranked in any way. The framework links to entry-level competencies via supplemental materials that map the competencies to the CPA Exam and specify particular skills that will be tested on the CPA Exam: Analysis, Judgment, Communication, Research, and Understanding. For example, to satisfy the functional competency of Research, a candidate must demonstrate the ability to research relevant financial accounting, tax, auditing, and attestation literature which is tested by demonstrating the following specific skills on the CPA Exam:

- Access relevant standards, rules, and other information.
- Employ relevant research skills for locating data.
- Articulate assumptions and reasoning associated with application of existing rules to a given problem.
- Articulate general concepts from existing rules and explain how those concepts apply across a range of problems, including problems not explicitly described.
- Employ relevant research skills over time to generate new information (i.e., as research skills change and the Exam changes).

To satisfy the functional competency of Leverage Technology, a candidate must demonstrate the following specific skills tested on the CPA Exam:

- Identify risks associated with technology and automated business processes.
- Access appropriate electronic databases to obtain decision-supporting information.
- Appropriately use electronic spreadsheets and other software to build models and simulations.
- Assess the degree of risk of technology and automated business processes.
- Adopt new technology over time; for example, XBRL for financial reporting.

Supporting this competence map is a web-based resource center offering curriculum resources and classroom materials vetted by an annual award process to identify high quality resources, strategies, and classroom techniques that can be used to help develop the desired competencies.

13.3.1.2 CGMA—Chartered Global Management Accountants

While the AICPA's Competency Framework was considered by its creators to be universally applicable to all accounting careers, nonetheless, a new and different competence-based framework was introduced in 2014 for Chartered Global Management Accountant (CGMA) candidates and practitioners. The Framework

(illustrated in Fig. 13.1) is considered to be the bridge between education and employment as well as a roadmap to lifelong professional learning and experience.

The competencies represent a more focused career path than the CPA, aimed at developing trusted finance and business strategists. The competencies are defined as knowledge and skills as well as attitudes and behavioral attributes of objectivity, integrity, and ethical behavior, and a commitment to continuously acquire new skills and knowledge. Four knowledge and skill areas are defined: technical, business, people, and leadership.

1. Technical skills (with eight competency areas) enable finance professionals to collect, store, process, and analyze information to be shared with various stakeholders. These include the preparation and dissemination of external and internal reports in accordance with professional accounting standards.
2. Business skills (with seven competency areas) enable finance professionals to use their knowledge of the business and its environment to transform data into insight that enables organizations to evaluate their strategic positioning, the alignment of their business models to their strategies, their performance, and opportunities for the future.
3. People skills (with five competency areas) are used to influence the decisions, actions, and behaviors of decision makers and others throughout the organization and its stakeholders.
4. Leadership skills (with five competency areas) are of three types: peer, functional, and strategic. They occur at different levels of proficiency. Peer leadership involves leading peers in and out of the finance function on issues that require an understanding of the financial implications of events and issues in the organization's internal and external operating environments. Functional leadership ensures that the finance function delivers its objectives to the organization. It takes place from the intermediate level onward, but mostly at the advanced level. Strategic leadership is exercised at the strategic level. Experts join with leaders in other functional areas to define, formulate, and oversee the implementation of the organization's strategy.

A fifth area, ethics, integrity, and professionalism, is pictured in the Framework diagram but is not discussed in the Competency Framework.

Each knowledge and competency area prescribes a series of skill sets to assist in the CGMA's professional development. For example, Financial Accounting and Reporting is a competency in the technical skills knowledge area. Professional Accounting Standards is one of three skill sets in the Financial Accounting and Reporting competency area and contains 10 skills spread over four proficiency levels; two foundational, three intermediate, three advanced, and two expert.

By way of comparison, in the learning outcomes model of the International Accounting Education Standards Board (IAESB) of the International Federation of Accountants of 2015, there are three domains: technical competence, professional skills and professional values, ethics, and attitudes.

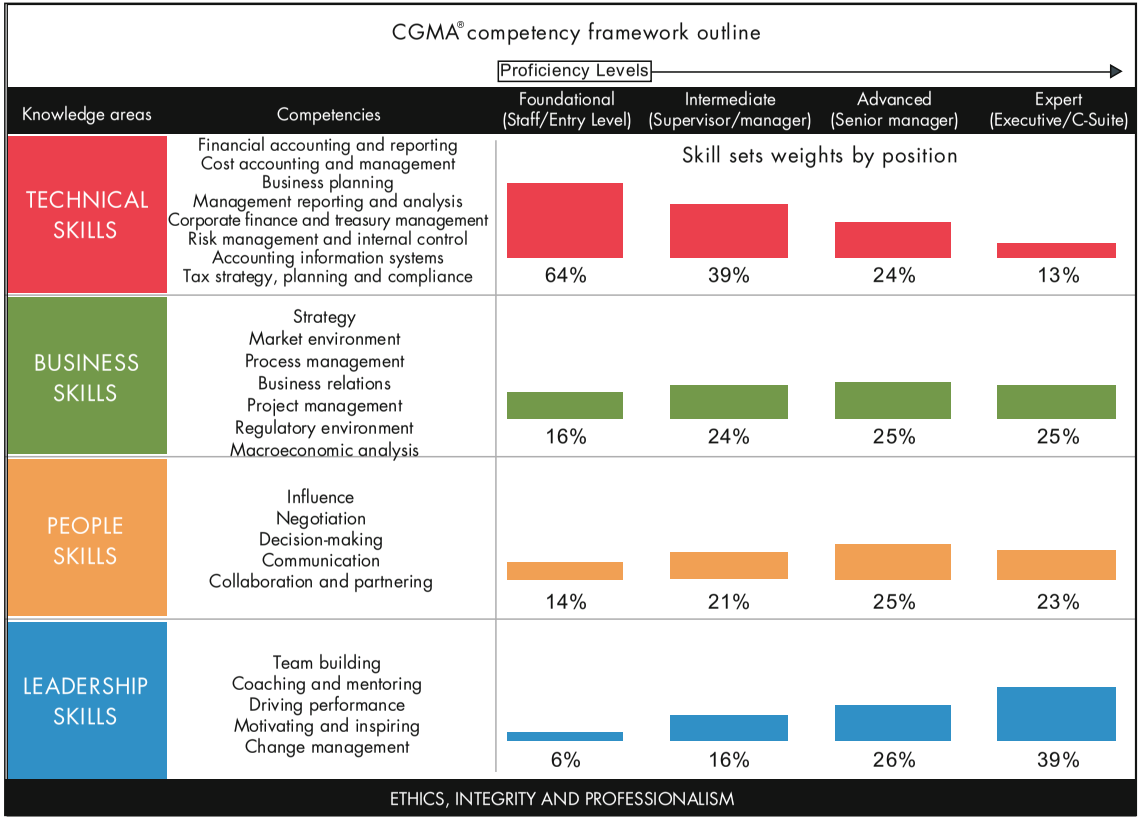

Fig. 13.1 Chartered Global Management Accountant (CGMA) Competency Framework of the American Institute of Certified Public Accountants in the USA (Reproduced with permission of the American Institute of Certified Public Accountants and the Chartered Institute of Management Accountants)

1. Technical competence is the ability to apply professional knowledge to perform a role to defined standard. Technical competence areas include: financial accounting and reporting; management accounting; finance and financial management; taxation; audit and assurance; governance, risk management, and control; business laws and regulations; information technology; business and organizational environment; economics; and business strategy and management. Learning outcomes for this domain at the intermediate level of proficiency are defined in International Education Standard (IES) 2.
2. Professional skills include intellectual skills, interpersonal and communication skills, personal skills, and organizational skills that the professional accountant integrates with technical competence and professional values, ethics, and attitudes to demonstrate professional competence. Learning outcomes for this domainat the intermediate level of proficiency are defined in IES 3.
3. Professional values, ethics, and attitudes include professional skepticism and professional judgment, ethical principles, and commitment to the public interest. Learning outcomes for this domain at the intermediate level of proficiency are defined in IES 4.

As noted previously, for each Chartered Global Management Accountants (CGMA) competency, specific knowledge and skills are identified at each of four proficiency levels linked to roles or positions that a CGMA might aspire to. The proficiency levels are usually linked to levels of the organization's hierarchy.

1. Foundational (Staff/Entry level)—this is responsible for achieving results through own actions rather than through others.
2. Intermediate (Supervisor/Manager)—this has limited or informal responsibility for colleagues and/or needs to consider broader approaches or consequences.
3. Advanced (Senior Manager)—this has formal responsibility for colleagues and their actions; and that their decisions have a wider impact.
4. Expert (Executive/C-Suite)—this has formal responsibility for business areas and his/her actions and decisions have a high-level strategic impact.

For example, Project Management is a skill set in the business skills area with 11 specific skills spread over four proficiency levels; three foundational, three intermediate; three advanced and two expert. The relative weight of each knowledge area relates to the importance of the defined skill sets at each proficiency level. For example, the relative weight of Technical Skills is very high at the foundational level but decreases as finance professionals move up to higher levels. In contrast, the relative weight of Leadership Skills starts at a very low level and increases as finance professionals move up to higher levels.

In comparison, the International Accounting Education Standards Board (IAESB) of the International Federation of Accountants (IFAC) defines three levels of proficiency: (1) foundation, (2) intermediate, and (3) advanced. For each level, learning outcomes are defined and related to the levels of ambiguity, complexity, and uncertainty that characterize the work situations relevant to the role of the professional accountant (Fig. 13.2).

Fig. 13.2 Chartered Global Management Accountant (CGMA) approach to defining the proficiency levels required for competency areas and subareas (extract) (Reproduced with permission of the American Institute of Certified Public Accountants and the Chartered Institute of Management Accountants)
Legend
Financial Accounting and Reporting is one of the eight competences in the Technical Skills area which is one of four knowledge areas. Professional Accounting Standards is one of three skill sets in Financial Accounting and Reporting competence area. Professional Accounting Standards has 10 specific skills spread over four proficiency levels; two foundational, three intermediate; three advanced, and two expert

The CGMA Competency Framework states that the competencies should be seen as integrated, as discussed by Lawson et al. (2014, 2015). This has important implications for the development of the syllabus and assessment. However, there is no information on the CGMA website on how such integration is to be achieved.

Also, as noted previously, ethics, integrity, and professionalism are not discussed in the Competency Framework and its component competencies are not identified. (This omission is difficult to explain, as IFAC's IAESB identifies 12 learning outcomes across three competency areas in this category: professional skepticism and professional judgment, ethical principles, and commitment to the public interest.)

13.3.2 Canada

The CPA Canada (CPAC) Competency Map (CPAC 2012a) identifies six technical competency areas and five enabling competencies. Enabling competencies reflect the personal attributes of a CPA: professional and ethical behavior, problem solving and decision-making, both oral and written communication, self-management and teamwork and leadership. Although there is some overlap in the personal attributes defined for USA CPAs, CGMAs, and Canadian CPAs, there are also some important differences. For example, ethics and integrity are not explicitly identified in the American (AICPA) CPA competence-based model, and mentioned but not discussed in the CGMA model; whereas they are developed in detail in the Canadian CPAC model and in IFAC's international model.

The technical competency areas are financial reporting, management accounting, audit and assurance, strategy and governance, finance, and taxation. Within each technical competency area are three or four competency subareas. Aspiring CPAs must complete the core, depth and breadth, and progression requirements by achieving a range of competency subareas defined by competency statements that make up each area as illustrated in Fig. 13.3 for the two competency subareas (financial reporting needs and systems and accounting policies and transactions) in the technical competency area of financial reporting. The rows in Fig. 13.3 list the specific competencies that fall into the six technical areas and subareas. The columns in Fig. 13.3 reflect the structure of the CPAC framework, with the column headed Entry specifying the competence requirements at the conclusion of the candidate's undergraduate education which is the point of entry into the professional program, C1, C2, and Core identify competencies that are a mandatory part of the professional education program. They focus on the application of knowledge, begin to introduce integration across different competency areas, and foster higher levels of problem-solving and decision-making abilities. For competencies that show the same exit level as entry level, there is no new material or concepts being introduced, however, the material and concepts previously acquired are integrated. E1 to E4 identify competencies that are included in the four Electives in the professional education program: performance management (PM), finance (FIN), assurance (AS), and taxation (TAX). These electives introduce new knowledge where it is relevant

			Core			Electives				Capstone	
Competency		Entry	C1	C2	Core	E1 PM	E2 FIN	E3 AS	E4 TAX	Cap 1	Cap 2
TECHNICAL COMPETENCIES											
1.	FINANCIAL REPORTING										
1.1	Financial Reporting Needs and Systems										
1.1.1	Evaluates financial reporting needs	B	A		A					>	>
1.1.2	Evaluates the appropriateness of the basis of financial reporting	B	A		A					>	>
1.1.3	Evaluates reporting processes to support reliable financial reporting	B	A		A					>	>
1.1.4	Explains implications of current trends and emerging issues in financial reporting	C	C		C			B		>	>
1.1.5	Identifies financial reporting needs for the public sector	C	C		C					>	>
1.1.6	Identifies specialized financial reporting requirements for specified regulatory and other filing requirements	—	C		C					>	>
1.2	Accounting Policies and Transactions										
1.2.1	Develops or evaluates appropriate accounting policies and procedures	B	A		A			A		>	>
1.2.2	Evaluates treatment for routine transactions	A	A		A			A		>	>
1.2.3	Evaluates treatment for non-routine transactions	B	B		B			A		>	>
1.2.4	Analyzes treatment for complex events or transactions	C	C		C			B		>	>

Fig. 13.3 Approach to defining the proficiency levels required for competency areas and subareas of CPA Canada (excerpt) (Adapted from The Chartered Professional Accountant Competency Map (2012) with permission of Chartered Professional Accountants of Canada, Toronto, Canada. Any changes to the original material are the sole responsibility of the author (and/or publisher) and have not been reviewed or endorsed by the Chartered Professional Accountants of Canada)

Legend

Competency: describes the qualifying skill to be developed by the completion of the CPA certification program. The wording of the competency reflects the highest level of proficiency attainable in one of the available modules in the professional education program

Entry: describes the level of proficiency with which candidates are expected to enter the professional education program

C1, C2, and Core: C1 and C2 describe the competencies all CPAs must develop. Core simply summarizes the level to be reached at the end of C1 and C2 for each competency

Electives: Candidates must choose two of the four available: performance management (PM), finance (FIN), assurance (AS) and taxation (TAX). Candidates who plan to practice public accounting are required to choose Assurance and Taxation as electives

Capstone: The final two modules are integrative and are common to all candidates. Capstone 1 focuses on strategic leadership, further developing, through teamwork, the enabling competencies, and integrating them with technical competencies. Capstone 2 prepares candidates for the final examination using complex case studies

Proficiency Level (Level A, B, or C as color coded): The level of proficiency that is expected to be demonstrated by a CPA upon qualifying to enter the profession for a particular competency at a particular point in the professional education program is indicated by A, B, or C

and explore the competency areas in more depth. The development of enabling skills continues.

Figure 13.3 illustrates that CPA candidates are expected to demonstrate competence at defined levels of proficiency. Three distinct and increasingly higher levels of proficiency are described, recognizing that candidates' abilities increase throughout the program (CPAC 2012a). Level C is the lowest proficiency required, whereas level A is the highest. At a C level, candidates must demonstrate retrieval and comprehension skills and be able to explain, describe, and demonstrate knowledge that is low to moderate in complexity for a routine situation. At a B level, candidates must be able to demonstrate knowledge, analyze problems, and draw logical conclusions in routine situations that have low to moderate complexity. Candidates must be able to perform a preliminary analysis of an issue, but the work will require the involvement of more senior professionals to review the analysis or provide the necessary guidance before the candidates are able to complete the work. At an A level, candidates must be able to demonstrate knowledge, analyze problems in sufficient depth, and draw conclusions in routine situations that have low to moderate complexity. In cases of nonroutine and moderate complexity, candidates are expected to be able to see some, but not all, of the interrelationships. In these situations, candidates will require some guidance from a more experienced professional to complete the task.

For each competency statement, a set of outcomes are identified. For example, competency "1.1.1 Evaluates financial reporting needs" in Fig. 13.3 has the following three outcomes identified in a separate table not reproduced here:

(a) Analyzes the economic and fiscal context in which the entity operates and its impact on financial reporting
(b) Assesses and prioritizes stakeholders in a financial reporting environment and their information needs in a decision-making context
(c) Determines and resolves conflicts/biases within a reporting environment

The Competency Map is supported by a Knowledge Supplement that identifies topics related to the competency. For example, competency (a) above "Analyzes the economic and fiscal context in which the entity operates and its impact on financial reporting" requires knowledge of the "objectives and fundamental accounting concepts and principles (qualitative characteristics of accounting information, basic elements" (CPAC 2012b).

The concept of progression is embedded in required competencies (CPAC 2013). At the start of the practical experience term, the aspiring CPA's work will be largely confined to retrieving and comprehending information. As further experience is gained, the aspiring CPA develops analytical ability and, by the end of the practical term, he or she can make effective decisions and solve problems as well as take on increasingly complex and less routine work.

Aspiring CPAs are not expected to demonstrate achievement of all the technical competencies, but must achieve a selection of competencies at levels defined by core, depth, and breadth, where Level 0 is purely administrative or clerical experience, Level 1 is professional experience that is lower than expected for a newly

certified CPA (i.e., includes tasks of a routine in nature or a low level of complexity, executed with a lower level of autonomy), and Level 2 is professional experience expected of a newly certified CPA (i.e., includes complex tasks undertaken with moderated to high levels of autonomy) (CPAC 2013). By the end of the term of practical experience, aspiring CPAs are required to develop the following competencies at the specified levels of proficiency:

- Core—proficiency in any three competency subareas in Financial Reporting and/or Management Accounting at least at Level 1 proficiency.
- Depth—proficiency in all of the competency subareas of one discrete competency area with at least two of the competency subareas at Level 2 proficiency; all others at Level 1.
- Breadth—proficiency in at least eight competency subareas with at least four subareas at Level 2 and the remaining at Level 1.
- Level 2 proficiency in all five enabling competencies.

Guidance is also provided to employers on assessing enabling competencies through a mentorship program. For example, aspiring CPAs can demonstrate how they have drawn on the enabling competencies while developing the technical ones by answering three-part questions which allow them to describe a situation, its implications toward achieving enabling competencies, and how it will affect their future behavior. This would be done for each of the five enabling competency areas (CPAC 2013).

The Competency Map of CPA Canada is a complex hybrid of several models. The underlying competency definition includes personal attributes as well as skills, has knowledge playing a secondary role, views competencies as observable skills through the skill outcomes identified, and takes an atomistic view of competencies. It builds on prerequisites that are earned through an undergraduate degree that covers specified subject areas and is consistent with the IAESB's approach although not identical at a detailed level.

13.4 Attributes of Competence-based Approaches in Accounting

In an earlier work, Boritz and Carnaghan (2003) describe competencies using the following dimensions:

1. Competencies as skills/abilities alone versus also including personal attributes or traits
2. Competencies as solely outcome-based versus also including knowledge
3. Competencies being activities/skills versus the results of activities/skills
4. Competencies as what is necessary for effective performance versus superior performance
5. Competencies being generally holistic (high level) versus atomistic (detailed)
6. Competencies as observable qualities versus hidden and inferred qualities

If the AICPA CPA, CPA Canada, and AICPA/CIMA CGMA competence-based frameworks are characterized according to these dimensions, all three include personal attributes and focus on what is needed for effective performance and tend to focus on observable skills. All three also tend to view competencies as activities/skills, although CPA Canada also provides the outcomes of the skills. Of the three competence maps, the CPA Canada one is probably the most atomistic, while the AICPA CPA one is fairly holistic. However, as noted earlier, the AICPA Core Competency Framework does not attempt to define the accounting practice-specific competencies, while the CPAC one does. The CGMA and CPA Canada frameworks also include knowledge required for the competencies as an additional document.

Table 13.1 uses the US-based National Consortium of Competency-Based Education Centers criteria which are based on Burke et al. (1975) and Wolf (1995) to further characterize the competence-based nature of the accounting bodies' education programs and assessment. These criteria are also similar to what Barrick (2016) provides as key elements of competence-based education. As noted previously, unlike the CGMA and CPAC designations, there is no professional education program provided by the AICPA for their CPA designation. Accordingly, where relevant, USA university accounting curricula are considered.

From this table several observations can be made:

- A first observation is that CPA Canada has not provided much detail on the development of the CPA Competency Map. However, to the extent the Competency Map builds on the competence maps of the three predecessor bodies, it does incorporate some occupational analysis.
- Second, as noted earlier, the AICPA CPA Core Competency Framework does not include accounting-specific competencies, so the required skills and attributes of a USA CPA are only partially specified.
- Third, all of the designations continue to require particular educational paths, not just demonstrating competence.
- Fourth, the CGMA competence-based program is quite new, and so while it appears that assessment will be criterion-based, this is not clearly stated on the CGMA website or other documents that have been located.
- Fifth, the three designations all use case analyses in whole or in part as the key means of assessing competence, which they regard as workplace simulations.
- Sixth, the degree to which the USA university accounting education programs are competence-based is difficult to determine. No data has been located that would help determine whether many USA universities would regard their accounting curricula as being competence-based. In contrast, the CPAC CPA and CGMA programs explicitly do derive their professional program curricula from their competence maps.
- Finally, both these bodies do assessments throughout their professional programs that should provide feedback to the candidate based on demonstrated competence throughout the program, while it would be up to the universities preparing students for the AICPA CPA exam on how often feedback is provided and whether it could be linked to competencies.

Table 13.1 Accounting bodies' education programs: characterization as competence-based education programs

Competence-based education program characteristic	Chartered Professional Accountants of Canada CPA (CPA Canada)	American Institute of Certified Public Accountants CPA (AICPA CPA)	American Institute of Certified Public Accountants/Chartered Institute of Management Accountants CGMA
Competencies based on analysis of occupational roles/ responsibilities?	Not clear	No	Yes
Competence Frameworks describe performance outcomes, or required skills and attributes, vs. inputs such as information or knowledge	Required skills and attributes and outcomes	Required skills and attributes (partial)	Required skills and attributes
Competence is determined by the person's ability to achieve the specified outcomes, not the length of time spent in any program or institution.	No	No	No
Competency statements facilitate criterion-referenced rather than norm-referenced assessment	Yes	Yes	Likely
Competence assessments done either in the work environment or in simulated work environment	Yes—simulation	Partial use of simulation	Yes—simulation
Competencies are specified and made public prior to instruction	Yes	Yes	Yes
The instructional program is derived from and linked to specified competencies	Yes	Unknown	Yes
Instruction that supports competence development is organized into units of manageable size	Probably	Probably	Yes
Instruction is organized and implemented so as to accommodate learner style, sequence preference, pacing, and perceived needs	No	No	Likely
Learner progress is determined by demonstrated competence.	Yes	N/A	Yes
The extent of the learners progress is made known to them throughout the program	Yes	Unknown	Yes

In summary, it appears the three models currently being used by the accounting bodies could be considered hybrids rather than purely outcome-based competence approaches.

13.5 Potential Strengths and Weaknesses of Current Competence-based Approaches in Accounting

Some strengths of the competence-based approaches in accounting documented above are as follows: Firstly, the CPA Canada and CGMA education and certification approaches appear to be in keeping with recommendations in Schwarz and Cavener (1994); Griffin (1995), and Spady (1994) for the need for multiple stakeholders to be involved in the competence determination process, including educators, industry members, and certification body representatives. The CGMA development process also involved students, which is also recommended. In the case of a profession, members of the public may also have legitimate rights to be included.

Secondly, CPA Canada and the CGMA designation do use workplace simulations (case analyses) as the key assessment activities, in keeping with a competence-based approach. The AICPA uses some cases for the CPA certification, as well as other forms of assessment. A simulation approach, rather than an actual workplace approach, may also help address Messick's (1984) concerns that differing circumstances can lead to highly variable outcomes. It would appear that the approaches taken to competence by CPA Canada (and possibly by the CGMA designation) are probably a mix between what Mulder and Winterton (2016) describe as "competence and integrated occupationalism" and "competence and situated professionalism," as there is consideration of knowledge, skills, and attitudes in the professional education program, combined with efforts to do formative and summative assessments using simulations of workplace experiences.

The simulations are supplemented with what Eraut (1994) calls *capability* evidence, which he felt was important for competence-based approaches in the professions. Capability evidence includes knowledge and understanding, personal skills and qualities, and cognitive processes. In addition, Eraut defines a professional's competence as having at least two dimensions: scope and quality. The scope dimension concerns the range of roles, tasks and situations for which competence is established. The quality dimension concerns the progression through several levels from student to novice to proficient practitioner to specialist and, ultimately for some, to being an acknowledged expert in an area of practice. Both the CPA Canada and CGMA incorporate these dimensions to at least some degree.

There are also some potential issues with the competence-based approaches in accounting. First, as noted in the chapter introduction, competence-based approaches to certification and professional education were adopted by accounting bodies in the USA and Canada largely because of "face validity" and growing interest elsewhere globally. However, there seem to be no published studies undertaken by the accounting bodies or others that have clearly established that the competence-based approaches that were adopted in accounting achieved their goals or led to improved learning outcomes.

Secondly, the competence frameworks examined tend to specify desired levels of competence of candidates to be certified by the accounting body, rather than what is

expected by students upon graduation from postsecondary programs. As such, the maps are arguably of less value to accounting educators as to what needs to be achieved in particular courses. As an exception to this, the CPA Competency Map does note the levels of proficiency expected by candidates at entry to the program, as well as upon completion of each module of the CPA professional education program.

Third, few, if any, Canadian universities use a competence-based approach to education or assessment, and so while university programs *cover* the technical competencies at the required level of proficiency to be accredited by provincial CPA bodies, it is not necessarily the case that graduates will be capable of performing them at the required level of proficiency. A review of "The Case for Change in Accounting Education" by Flood (2014) also notes that a competence orientation may not be a sufficient goal for university education programs. At least as important, she argues, is the development of intellectual capabilities to critique current practice and develop innovative ideas.

A fourth issue arises in having sufficient room in university programs to cover all the required competencies. Given the large number of competencies and related knowledge elements, anecdotal evidence suggests it can be extremely difficult for instructors to simply cover the required material in the specified courses, never mind having the time to help students achieve the specified competence. No formal studies concerning this potential issue of "curriculum overload" in accounting have been located. The risk of having too much material to cover to achieve the competencies was previously noted by Monjan and Gassner (1979). Students may also feel overwhelmed by what they perceive as an unreasonable amount of material.

Finally, another potential issue is whether the adoption of competence-based approaches has improved entry into the profession of those with alternative qualifications, such as immigrants, professionals in other areas, or those without formal education in many of the competence areas. This objective was not stated by CPA Canada or the AICPA as a rationale for adopting competence-based approaches, but is still often touted as a potential benefit of competence-based approaches more generally. As CPA Canada and the AICPA still require particular education backgrounds prior to writing the certification exams, it would appear there are still barriers to entry for those with alternative qualifications, though limited exemptions are possible. The Chartered Institute of Management Accountants (CIMA) accepts a variety of educational backgrounds but still generally requires evidence of having completed particular programs.

13.6 Comparison to Other Professions and Future Directions

As noted earlier and in Chap. 42 by Ten Cate (2016), the medical profession has also been exploring competence-based approaches. There are some similarities in the approaches of both groups. Both professions in Canada have created competence-based frameworks for use by educators and workplaces. Ten Cate and others have

also noted the risks of overly detailed lists within competence frameworks, which has tended to happen in both accounting and medicine. Ten Cate notes the development of milestones within medical training to help understand the level of competence a resident should achieve at each stage in development. This has also been done to some degree within the CPAC Competency Map, and the CGMA Competency Framework, though not with the AICPA Core Competency Framework. Within the CGMA Competency Framework, levels of competence are specified as an accountant moves through different stages of their career, while within the CPAC Competency Map, different levels of proficiency are identified as each module in the professional education program is completed and as workplace experience is gained.

However, there are also a number of differences between what has happened in accounting and the medical profession. First, while accounting undergraduate programs in Canada must show they cover the CPAC Competency Map at the stated levels of proficiency within the approved list of courses, they do not generally use competence-based approaches. In contrast, Ten Cate (2016) notes that university medical curricula are making a greater effort to implement concepts of competence-based education, including time-flexible programs and competence-based assessment at the undergraduate level. The reduced emphasis on this in accounting may stem from the professional bodies controlling professional education after undergraduate programs, and making use of this to implement competence-based programs there.

Second, Ten Cate also notes greater concern being expressed with the validity of the competence-based assessments in medicine, while the use of cases in accounting as a workplace simulation seems to have been fairly uncontroversial. However, the assessments in medicine may be more likely to be in the actual workplace, rather than through use of a simulation, which gives rise to greater variability in the assessment because of external factors.

How the frameworks are organized is also different in Canada. The Canadian medical framework discussed by Ten Cate is organized into roles, with each role linked to key concepts, key competencies, and enabling competencies. In contrast, the CPA Canada framework does not identify roles for accountants, but rather lays out the competencies according to technical areas, such as financial reporting and audit, and enabling competencies, such as professional and ethical behavior. The enabling competencies are effectively treated as being equally required in all situations.

In addition to considering some of the competence-based developments in medical training, what are some other possible future directions for competence-based education in accounting? One obvious one is further implementation of competence-based education into undergraduate programs in Canada and the USA, similar to what has happened in medicine. This could require considerable rethinking of how accounting programs are operated, especially if ideas such as flexible timing to allow learners to proceed at their own pace are implemented. Such changes would require approval at the University level, which raises the question of whether universities are ready for competence-based approaches. Tamburri (2014) notes that

some USA colleges and universities are already offering competence-based education in various areas, with particular emphasis on degrees not being directly linked to credit hours, but rather to achieving competence. A key example is Western Governor's University, but the article also notes offerings by Southern New Hampshire University and the University of Wisconsin. A key impetus of competence-based approaches in the USA is a belief that it can reduce the cost of postsecondary education.

In Canada, competence-based approaches may be driven more by the need to assess foreign credentials and to facilitate transfer credit assessment across institutions. For example, Albert et al. (2013) suggest that a competence-based approach based on portfolio assessment could significantly help in reducing the problem of underemployed internationally trained professionals. A research study by the Association of Registrars of the Universities and Colleges of Canada (ARUCC 2014) on improving transcript standards and transfer credit assessment specifically identified competence-based education as a means to facilitate student mobility across institutions for all programs. Several provinces have been considering competence-based approaches as a means of facilitating transcript evaluation and transfer credit. There thus seems to be increasing interest in and scope for the adoption of competence-based approaches in postsecondary education in Canada and the USA.

Another interesting future direction is reconsidering how the levels of proficiency are defined. The maps currently tend to incorporate an approach similar to Bloom's (1956) taxonomy. For example, the CGMA syllabus (2015a, b) has a hierarchy of learning objectives that comprise knowledge, comprehension, application, analysis, and evaluation. However, there has been a revision to Bloom's taxonomy which was developed and summarized by Krathwohl (2002). The new taxonomy is two dimensional, with six cognitive dimensions (remember, understand, apply, analyze, evaluate, create) and four knowledge dimensions (factual, conceptual, procedural, and metacognitive knowledge). This richer conceptualization might be helpful in better characterizing and communicating the competencies of professionals, and is somewhat similar to the ideas found in Cheetham and Chivers (1998), which attempts to fuse the "reflective practitioner" ideas of Schön (1983) to competence-based education.

13.7 Conclusions

Competence-based professional education and certification are well established in Canada for the professional programs and certification in Canada, with CPAC continuing to maintain the Competence Map that drives its professional education programs and assessments. The recent competence-based approach being taken by the new joint US AICPA/CIMA CGMA designation, and its use of more competency-based features, including greater flexibility for the learner to proceed at his or her own pace, indicate continued support for competence-based professional certification in the USA.

When considering particularly the CPAC competence-based framework and that for the CGMA designation, elements of CBE discussed in Barrick in Chap. 12 are generally present, such as the use of performance-based and authentic assessment (primarily with cases); explicit learning outcomes, typical use of criterion-referenced assessment, defined competencies for the education program, and integration of skills and attitudes into the learning and assessment processes. Some other elements have been incorporated in the CGMA framework as the newest competence-based approach, such as responsiveness to individual needs, flexible timeframes, and the use of core problems to organize the curriculum. In contrast, the AICPA Core Competency Framework is probably closer to a competence-oriented education as described in Chap. 1 (Mulder and Winterton 2016)—the curriculum and certification was not designed around competence, but instead the core competencies were specified and mapped to the existing assessment structure after the fact.

The problem of detailed competencies lists is evident in the CPAC Competence Map, but the approach taken by CPA Canada has also avoided some other pitfalls expected for professional competence-based models by including a knowledge supplement, consulting with academics and practitioners in developing the Competency Map, and by relying on workplace simulations in the form of cases to minimize variation in workplace circumstances that might affect the validity of assessments. The overall approach taken by CPAC and the CGMA designation is closer to what Mulder and Winterton (2016) refer to as task-oriented specific competence, with competencies specified in terms of what accountants need to be able to do in various subdisciplines, although this is somewhat different from the medical profession's task-oriented approach in Canada, which has organized competencies around particular roles.

As the preceding discussion and summary would suggest, the accounting profession's approach to competence-based professional education and assessment is probably closest to what Mulder and Winterton identify in Chap. 1 (2016) as "competence and integrated occupationalism": knowledge, skills, and attitudes are addressed together in the CPAC and CGMA education programs, and development of a professional identity is an important part of the curricula, although how professional ethics and values are incorporated into the CGMA program is less clear. However, there are also some elements of what Mulder and Winterton refer to as "situated professionalism": where the emphasis has been on providing teaching and assessment materials that emphasize the use of the knowledge and skills in professional contexts.

As noted in Boritz and Carnaghan (2003), there continues to be no published evidence on whether a move to competence-based professional education improved learning outcomes. Research on this would be extremely helpful in evaluating whether the efforts to adopt competence-based education are worthwhile. It does however seem likely, as Hall (1994) noted that competence-based approaches do have the merits of forcing careful review of what curricula need to cover, what professionals need to do, and improving communication among all stakeholders including students on how they would be assessed. With competence-based approaches also being adopted in the medical profession, there are additional opportunities for

PABs to learn how to refine the work done to date. Expansion of competence-based approaches to undergraduate programs in Canada would seem a plausible expansion of CPAC's focus on competence-based professional program and approach to certification.

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Chapter 14
NVQs and Approaches to Competence in the UK: Contexts, Issues and Prospects

Peter Stokes

14.1 Introduction

Competence frameworks are a long-standing part of the (United Kingdom) UK training and development environment (Chang et al. 2013; CIPD 2007, 2013, 2014; Hirsh and Strebler 1994; Kayes and Kayes 2005; Sparrow and Bognanno 1994). In the British context, these initiatives often encompass, although not exclusively, National Vocational Qualifications (NVQs). NVQs produce strong and contrasting reactions; proponents of NVQs evoke considerable support and commitment to the scheme, its awards and merits, while critics of NVQs question their worth, viability and relevance. Against this backdrop, competence frameworks have nevertheless been frequently viewed by governments and employers' bodies as a means of responding to skills gaps in the economy and poor economic productivity.

The above-noted prevalence, operation and contested nature of competence frameworks in the UK setting are the product of a particular conjunction of paradigmatic and historical sociopolitical influences in relation to vocational and professional training. However, these factors are largely underexplored and this constitutes an important oversight. This Chapter seeks to address this by responding to the question 'what are the paradigmatic underpinnings of competence frameworks in the UK context and how does this influence their structure, operation and development?'. This Chapter elaborates the question in a number of steps:

1. It provides an outline of the UK context in relation to competence frameworks, vocational and professional training in general, and surfaces the characteristics which point at underlying paradigmatic assumptions in relation to these domains.

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2. It describes and explains the underlying paradigm that has driven competence frameworks in the UK.
3. It illustrates the impacts of this approach to competence by the use of a case study and identifies some potential future directions for the development of competence in the UK context.

14.2 The Global Ascendency of Competencies: A Contextualisation in the UK

The contemporary global picture of competence has developed into a rich and extensive set of domains and become established as an integral part of many managerial and organisational lexicons and settings across a range of UK corporate and public sectors (Barth et al. 2007; Beinecke and Spencer 2007; Bouzdine-Chameeva 2006; Boyatzis 1982; Cappellen and Janssens 2008; CIPD 2014; Clark and Armit 2010; Department of Education 1986; Department of Health, 2009; Le Deist and Winterton 2005; Nimmagadda and Murphy 2014; Nursing and Midwifery Council UK 2014; Tilestone 2011; Winterton and Winterton 1999; Woodruffe 1992). Much of this work is derived from, and built on, the prevalence and impact of North American influences and is a current 'systematic' attempt to *classify*, *categorise* and *label* competencies (Boyatzis 1982; Engwall and Zamagni 1998; McClelland 1973).

In the UK context, Gibb and Megginson (2000: 152) signal that entities such as government departments have, for example, demonstrated a keen interest in competence frameworks and the ways in which competencies may assist them to structure and control their activities. For example, the Civil Service Competency Framework involves three areas ('setting direction, delivering results and engaging people') listing more detailed competencies for different roles and levels of responsibility (Civil Service Human Resources 2012).In more in-depth sections of the scheme, the framework also maps onto the various levels of the NVQ national framework. Equally, competence and competency frameworks are developed, adopted and implemented by private companies and organisations. The development of these frameworks may involve the use of consultants or pan-industry organisations or 'in-house' products. For example, KPMG, one of the leading private consulting firms, employs nine 'competencies and values' for firm employees to adopt (KPMG 2015). A key driver underpinning developmental work on vocational and professional training approaches in the UK has been the perennial issue of poor economic productivity. In an attempt to address this repeatedly, UK governments have sought to develop a nexus between government-supported policy and educational frameworks and private sector voluntarism and engagement; however the outcomes have been patchy and variable.

In the development of any area of work activity, a perhaps predictable and anticipated aspect is an a priori argument over delineations in *nomenclature*. Competence in the UK (in connection with wider global debates) has been no exception, and

there have been the almost inevitable definitional conflicts over competing meanings of terms – including, for example, the central debate over whether the term 'competence'(competencies) or 'competency' (competencies) should be employed. The Chartered Institute of Personnel and Development (CIPD) – the UK human resources professional body – suggests that:

> In the past, HR professionals have tended to draw a clear distinction between 'competencies' and 'competencies'. The term 'competence' (competencies) was used to describe what people need to do to perform a job and was concerned with effect and output rather than effort and input. 'Competency' (competencies) described the behaviour that lies behind competent performance, such as critical thinking or analytical skills, and described what people bring to the job. However, in recent years, there has been growing awareness that job performance requires a mix of behaviour, attitude and action and hence the two terms are now more often used interchangeably. (CIPD 2014)

The evolution of competencies in the UK has been long and complex involving growing interest by, and formulation of, UK government and organisational agendas, policies and actions around issues of skills, talent and competence (including by way of illustration: Dearing Report 1997; Leitch Report 2006; Manpower Services Commission 1981).The majority of this work focuses on attempts and initiatives to understand and categorise roles, structures and trends and, moreover, to identify skills gaps at local, organisational, regional and national levels (Edwards-Zara 2005: 420).Competence has played a central role in these national schemes and policies, and this has been so much the case that it has prompted some commentators to note that during the 1980s and early 1990s, the development of competency-based training had become 'a veritable industry' (Hirsh and Strebler 1994: 81). Similarly, in the same period, Sparrow and Bognanno (1994: 57) suggested that competency approaches were 'a rising star', and naturally this activity and momentum led to a 'burgeoning academic literature on the topic' (Garavan and McGuire 2001: 144).

In its contemporary form, competence in general, but perhaps particularly in the UK setting, has been founded on a number of broadly accepted assumptions and principles. These include classifying skills, contexts or behaviours into discrete categories and delineating *boundaries* around facets and sectors of work. This approach aims to distinguish and arrange elements of competence and, subsequently, to develop objective judgements, measures and assessments in these domains. This approach has led to the generation of varying kinds of competence primarily including, on the one hand, individual or personal competencies and, on the other hand, organisational competence (Murray 2003:306). Individual competence pertains to a skill, or set of skills and behaviours, that enables a person to do his or her role or job. For Hirsh and Strebler (1994: 83), competence relates to the context of a particular job, the linkage of competence with performance and specific behaviours observable in the job. In summary, it can be seen that, in many regards, competence is replete and embedded in the UK setting. However, more importantly, how competence comes to be viewed and structured in these above-mentioned ways points at less-commented deeper, underlying drivers for competence in the UK sociopolitical context, and these are discussed below.

14.3 Predilection for the Experiential and Pragmatic: Implications for Competence

The British historical cultural fabric manifests a strong propensity towards valuing the empirical, pragmatic and experiential (Priest 2007). Empiricism employs the senses to make prima facie objectified assessments of phenomena, and pragmatism is a viewpoint that looks for the 'practical' in situations and outcomes (Bryman and Bell 2011). Equally, competence frameworks, with their delineated categorisation, labelling and assessment of performance of abilities in relation to them respond well to these atmospheres. Both empiricism and pragmatism are intrinsically linked to the experiential-valuing learning through doing and reflection on action. These traditions within British thinking are pointed at, and underscored by, contemporary and classical commentators alike (McEwan 2001: 73–5; Stokes 2008:5). The reification and celebration of practical and applied skill sets, as opposed to conceptual, academic and intellectual approaches (often seen as the domain of higher education and individuals who access it), have historically been widely adopted across large areas of British industry, and this empirical and pragmatic tradition is often contrasted with European continental philosophical traditions, particularly French Thought, which espouse notions of idealism, visionary stances, postmodernism, poststructuralism and ethereal conceptual thought (Chanlat 1994; Maclean et al. 2006; Stokes 2008).This prevalence of pragmatism and empiricism means that the practical, vocationally linked sense making by looking back over experience (as opposed to theoretical, conceptual and envisioning forwards, i.e. more continental philosophically oriented) aspects of competence frameworks is generally well received in the UK. Alternatively expressed, competence cast in the above manners suits a British mindset well.

Historically and conventionally the above context derives in large part from the hegemonic dominance of positivism and modernism as shaping forces across management and organisation. Positivism and modernism make sense of situations through objectivity, quantification, measurement, categorisation, subcategorisation of phenomena, representation (i.e. labelling) and scientific method-informed testing (Clegg et al. 2011; Stokes 2011: 96). As such, there has been a tendency in British settings to reify the 'practical' over the 'theoretical' and to focus on the 'hard' over the 'soft' aspects of managerial and organisational contexts. While, in recent decades, in UK academia there has been a marked increase in interest in more sociologically and critically informed ('soft') approaches and critical management perspectives (*inter alia* Alvesson and Willmott 1992, 2003; Clegg et al. 2006; Clegg and Haugaard 2011; Gabriel et al. 2009; Goleman 1996; Honey and Mumford 2000; Linsteadet al. 2009; Nonaka and Takeuchi 1995; Schein 1992; Simpson et al. 2014; Stokes 2011; Willmottet al. 2011; Wright et al. 2001), there remains nevertheless a powerful legacy of latent pragmatism and empiricism in operation in British thinking. Through a critical perspective lens, competence frameworks are critiqued as modernistic, positivistically informed mechanistic, functionalistic, and ultimately simplistic, devices with which to represent work practices and cultures. They are

seen as mechanisms whose ultimate purpose is to achieve managerialistic oppressive control of worker identity and roles in the monochromatic goal of achieving 'best practice', optimal effectiveness, efficiency, performativity and ultimately enhanced profitability. For employees who have iteratively built up skill sets based on communities of craft practice, competence frameworks may seem like an imposition and colonisation of their skills and professional domain (Stokes and Oiry 2012). Moreover, Gabriel (1999) and Gabriel and Lang (2006) have indicated that many spaces in the minds of employees, candidates and consumers may not be accessible to managers and the organisation and as such remain 'unmanageable' which presents an interesting tension for competency frameworks. If, to be measured, a competency must be explicated (drawn out rather than left implicitly embedded and unsurfaced), then this means that it has to be possible to reveal and portray a competency at all times in order to measure its shape, form, magnitude and performativity, and this may simply not always be feasible.

A further important point to elaborate in relation to competence in the British context is the operation of perceptions of 'worth' and 'standing' of competence-based vocational training qualifications which are linked to perceptions linked to social class. This form of perception may indeed be identified in other national educational systems; however in the UK context, it is a particular cultural configuration that acts on competence-based approaches. While competence sits well within a broad backdrop of pragmatism and empiricism, nevertheless, competence-based qualifications and especially NVQ-type qualifications may be perceived by certain observers as being of lower standing and merit than qualifications which emanate from, for example, professional bodies (e.g. accountancy) and degree-based higher education awards (Shaw 2004). This is an important divide which is worthy of underlining in that it begins to separate out professional qualifications from vocational training. In the UK context, 'professions' cover an extensive span of perceived social standing with, for example, medicine, accountancy, judiciary and the legal profession constituting the higher ground. Wider professions such as, for instance, purchasing and supply managers, academic administrators or human resources managers may not necessarily be seen, in a British context, to hold such high standing. Compared to the arena of professional qualifications, vocational qualifications may, in a populist sense, be generally viewed by some observers as lower ranking compared to degrees or higher-level professional qualifications. It is also perhaps worthy of note that it tends to be individuals from less-privileged socioeconomic backgrounds who engage with vocational training. Furthermore, vocational training is often directed towards more semiskilled roles than highly skilled fields. This particular belief may also represent a view held in some sections of the upper and middle classes where university (and particularly the elite Russell Group, research-intensive universities) may represent *the* desired and valued educational option. In this view, NVQs are seen as a 'down-market' option targeted at semiskilled socioeconomic groups. Nevertheless, competence-based approaches might be more democratic because they can be individually tailored and can be obtained experientially in the workplace and through accredited prior experiential learning (APEL). It is also, on occasion, argued that such an approach is less elitist

than 'traditional' classroom-based learning in higher education environments (Pate et al. 2003: 172). Gendler (2010: 1), poignantly, contextualises the underlying cultural tensions by using an international comparison:

> In Germany engineers study for non-academic qualifications, and they are highly regarded by society. Perhaps even more so than academic graduates. Here an NVQ is sniggered at by the educated elite and apprenticeships have virtually disappeared.

These conflicting beliefs can have important, and sometimes negative, impacts on the experience and identity of learners. However, in contrast to the perception of NVQ-style competencies in educational settings, within corporate and organisational settings, internal or industry-based competence frameworks are likely to be valued within the organisation.

14.4 Case Study and Application: The United Kingdom NVQ Competence Framework in Action – Structure, Opportunities and Challenges

14.4.1 The NVQ Competence Framework

The National Vocational Qualifications Framework, which is a key product of that context, is one of the primary mechanisms for the delivery of competence and vocational education and training (CVET) and competence-based qualifications in the UK. One of the issues which CVET has had to confront in the UK context has been the repeated, and often politically motivated, reorganisation of government departments and quasi-governmental agencies that are charged with managing education and business skills (Roe et al. 2006). The main organisation in England and Wales having responsibility for shaping and controlling competence-based vocational qualifications is now the Standards and Testing Agency (STA). In Scotland, the parallel role is conducted by the Scottish Vocational Qualifications Authority. In England this body comes under the overall control and influence of government departments and their agencies. These include the relatively recently reformed Department for Business, Innovation and Skills (BIS) and its satellite Skills Funding Agency (SFA). This is aligned with the parallel Department of Education linked with the STA (which replaced the Qualifications and Curriculum Authority in 2012). Constant changes in the way NVQs are organised, conducted, controlled and monitored have seen a range of governing bodies come and go. Until 2010, the Learning and Skills Council (LSC) was charged with managing government funding for the further education sector (ages 14–19) was the principal body. In its wake the Skills Funding Agency (SFA) and the Young People's Learning Agency have been established. Linked to the SFA, some eighteen Sector Skills Councils (SSC) and an associated four sector skills bodies have been created. These bodies are employer-led associations linked to particular industries such as retail, construction, automotive manufacture and so on (Federation for Industry Sector Skills and

Standards 2014). These transformations are linked to changes in national political regimes and policies and the resultant reconfigurations of government departments and policy delivery units. Moreover, within their period in office, governments also reassess priorities and targets, and this, too, has led to the dismemberment and reshaping of departmental and agency structures. These bodies inform and guide apprenticeship and competency vocational qualification training and awards within their respective industries and business sectors. It may be argued that, rather than create the impression of responsiveness and dynamism, such frequent changes in the government of the overarching infrastructure of competency schemes risk creating a sense of uncertainty and overbearing bureaucracy and cause confusion and undermine confidence around the credibility of NVQ-type awards. The frequent changes in the vocational and competence-based environment are arguably symptomatic of a number of prevailing impediments to achieve vocational and professional qualification effectiveness in the UK context, including the political short-termism of UK policy-making frustrated by frequent ministerial changes in portfolio and direction; an inability to overcome red-tape, 'quality' and administrative bureaucracy in order to transform policy into action and ultimately economic productivity increases (of which the NVQ framework may perhaps be cited as an exemplar); and a disconnectedness between the impact of vocational frameworks (as they are often framed) from the reality of work tasks and outcomes they seek to inform and shape.

While UK government agencies and departments are a major influence in relation to NVQs, skills and competencies, a wide range of private awarding bodies also operate effectively creating a *market* in the sale of competence-based training and awards. This marketisation is a product of the commodification processes and effects of the dominance of modernism. Well-known illustrations of such organisations include *Edexcel* and also *City and Guilds*. Thus, awarding bodies operate as commercial entities effectively marketing and selling advice and registration for the affirmation and right to deliver and receive an accredited NVQ award for individuals, organisations and pan-industry bodies (Whiddett and Hollyforde 2003, 2007). This is an important facet of the UK setting and underlines a clear illustration of the commodification and marketisation of competencies as offered through the NVQ framework. In other words, it is not uniquely a public sector-administered scheme. This marketisation is, of course, in an ongoing context of privatisation of government and public bodies in which the UK appears to lead Europe. These processes create a commercial world around competence-based qualifications.

In the UK, competence-based awards, like all qualifications, are positioned in the national qualification framework. Awards are placed into eight levels with each level of award having a particular set of skills, knowledge and behaviours commensurate with that level. For example, a level 1 award will offer the most basic task skills; a level 3 award is broadly recognised as being equivalent to an English A-Level (Baccalaureate) and anticipates skills of analysis and judgement, 'skilled worker'; level 4, technician; level 6, bachelor degree; level 7, masters; and level 8, doctoral level. Competence-based CVET awards can be attained at all of these

levels in the UK, but the awards achieved are predominantly at levels 2 and 3 (Roe et al. 2006).

National Occupational Standards (NOS) represent a key instrument of the UK national competence system. The NOS are produced through consultation between sector bodies, government and quasi-government agencies, private accrediting bodies and employers. The standards lay down clear prescriptions and guidelines in a wide range of vocational and career domains. As a candidate works through a given set of vocational standards, it is possible to achieve an award. In the UK context, NVQs are structured in a specific manner. Awards are made at particular levels and each award is made up of 'units'. The purpose of a unit is to cluster together particular set of skills deemed important for specific work tasks, process and situations. For example, it might be that a person undertaking a Customer Service Award studies a unit on 'Greeting and Receiving the Customer'. The delegate or student must complete a predetermined combination of units on different aspects of the vocational roles and situations from within the award. In turn, each unit within the award will be composed of subunits or 'elements'. For example, within the Customer Service Award, an employee/student could undertake (extracted from the Edexcel NVQ Level 3 Customer Service Award):

Unit 39: Build and maintain effective customer relations
Unit 40: Deliver seamless customer service with a team
Unit 41: Recognise and deal with customer queries, requests and problems

Vocational qualifications are assessed by qualified assessors, who must themselves undertake a vocational award concerned with the competencies required for assessment. The act of assessing competencies takes place through a number of methods which encompass, for example, *direct observation by the assessor*, *personal statements* (written by the candidate about aspects of the role they have achieved), *witness testimony* (written by a manager or expert who can corroborate the candidate's work and achievements) and *professional discussion* (which is a planned and structured discussion between the assessor and the candidate to distil aspects of expertise and accomplishment in the candidate's role/job).

As alluded to above, concerns have been expressed by individual candidates, employers and representative organisations, as well as educationalists over NVQ regimes and competence frameworks in general (West 2004). At the micro-operational level, these have often centred on the processes of evidence collection and assessment being overly bureaucratic and mechanistic. Concerns regarding inflexibility of standards and their applicability to live and everyday situations have also been voiced (Le Var 1996; Reid 2002). Many UK competence frameworks have been criticised for being simplistic and reductionist in attempting to capture complex realms of human activity and behaviour. The categorisation and classification of vocational and career domains into skill subsets are seen as challenging and perhaps do not always represent the holistic and integrated nature of an individual's organisational life. It might be argued that competence represents only an *approximation* of work realities experienced by candidates, which leads to ever more

complex descriptors and a proliferation of jargon (Grugulis 2002; Oates 2002). For some commentators NVQ-style qualifications are seen as potentially anti-intellectual and as involving a 'dumbing down' of learning. They are also pejoratively charged with offering awards only for skills that people already possess rather than providing strong developmental possibilities. However, these criticisms concern (a) a lack of underpinning theoretical knowledge which appears unreasonable when one looks at, for example, level 3 NVQs for electricians in electrical contracting and process operatives in the chemicals sector, and (b) the competent/not yet competent dichotomy that allegedly promotes a lowest common denominator approach.

14.5 Background Case Context, Focal Issues and Methodological Issues

The case is based on a 3-year consultancy project with a major utility corporation based in the United Kingdom. A quasi-private training provider had secured a competitively tendered high-value contract to develop an NVQ nationally based Level 3 Customer Service Award for approximately 90 customer-facing employees here termed 'customer officers' (COs). The CO was a new role which had been created at the same time as a technical officer (TOs) role. The TOs were intended to look after the water network 'behind the scenes' and out of sight of the customer. The COs were controlled from a central control room at the utility company headquarters which received calls from customers. The customer calls would typically concern problems with water leaks on their property, installation problems, water which had appeared or pavements or roads and billing queries. The CO would then be assigned the call on their computer and pick it on the schedule and visit the property. A series of jobs would be assigned throughout the day.

The author acted as researcher/assessor and was an academic member of staff of a training provider delivering consultancy, training and development. As this was the first time an NVQ contract of this nature had been delivered by the provider, it was a programme requirement that the assessor/researcher develop the experiences and portfolio to become a qualified NVQ assessor, simultaneously with assessing the COs for their award. This is not the most common way of undertaking assessment but it was permitted. As the NVQ competency assessment required observation, the author/researcher was also obliged to wear overalls, boots, a yellow jacket and, at certain points, a helmet. To all intents and purposes, he looked like a CO operative. Typically COs would have responsibility for a particular geographic area, and their day would involve driving to addresses, dealing with the query and then updating a laptop connected to the control room. The usual routine of contact between the researcher/assessor and the individual COs was for the author to make telephone contact with the CO to arrange to spend a day with them.

The utility company, like all such companies in the UK, had become privatised at the beginning of the 1990s, and companies and markets formed from the pre-existing monopolistic public entities. This had led to gradual then progressively radical shift towards a (more positivistic and modernistic) focus on effectiveness, efficiency and return on investment. Overall, it led to the introduction of profit-orientated operation, cost reduction and a heightened sense of metrics and managerialism in the organisation. These changes were a source of considerable discontent among employees. The post-privatisation regime created a series of shifts in the corporate culture of the organisation, which had a major impact on long-standing employees such as the COs. Predominantly male and middle-aged, approximately 60 percent of COs had started their employment with the company in manual labour roles digging holes to access and install water pipes. They had then progressed to minor engineering and craft supervisory roles – roles in which they had distinctive identity and pride. Many of the established COs took considerable pastoral-like care over their section of the water network. As one CO said: 'we like everything to run right and smoothly on our patch and we don't like to be seen by other COs to be running a shoddy show – it's a bit of a badge of honour thing'. Under the CO and TO role split, the hiving off and loss of the technical and engineering aspects of job was seen as a major concern and loss of identity for many CO operatives. The introduction of the NVQ scheme was viewed by many as a further erosion, intrusion and imposition on their work identity.

Methodologically, the research aspect of the researcher/assessor work adopted an ethnographic, interpretivist approach recognising the subjectivities at play (Van Maanen 1988, 2010; Eriksson and Kovalainen 2008). Extensive notes were taken on conversations, events, incidents and situations. With the author spending all the working day with the COs, this afforded a very rich data set as the author was virtually living with and experiencing the CO's life. Against the above background and methodological contexts of the vignette, a range of poignant focal issues emerged. Spending all day with COs meant that many aspects of their professional and private lives were discussed, and a strong acquaintance was established between the researcher/assessor and the 13 COs he was assigned to assess. Break visits to pubs, 'pie and mash' shops and 'greasy spoon' cafes were an integral part of the experience against which the sense making of the competence work occurred (Weick 1995). This afforded the researcher a profound 'lived experience' opportunity with the employee respondents (Knights and Willmott 1999). The researcher/assessor was mindful to avoid letting the relationship impinge on the conduct of the assessment process.

The post 40-year-old section of the cohort (all male) tended to be variously bemused and disillusioned with the experience of undertaking NVQs and a competence framework. The NVQs seem detached from COs''lived reality', as one respondent commented: 'What the ******* hell has this got to do with the job anyway?' (Respondent C).

Older COs, almost all male, lamented the recent technical-backroom/customer-facing split in their role and saw the NVQ programme as a further emasculation of their craft-technical prowess and responsibility: 'They [the management] have killed this job. It used to be fantastic. We used to control our networks and know what was going on. Now it's a soft paper-pushing job' (Respondent I).

The younger (under 40 years old) COs produced a different approach to the introduction of the NVQ programme. There was a group of COs aged between their late twenties and early thirties who generally were more comfortable and accepting of the process. This group comprised both men and women. Their acceptance was in part due to earlier experiences and accomplishments with competence processes. It was also because they were relatively new recruits and wished to secure permanent posts. Moreover, this cohort did not have the extensive water network technical experience built up in an earlier and by gone era by the older cohort. These apparent technical lacunae were a frequent source of half-joking jibing and banter between the COs. The group of COs who were in their late thirties was a mixture of employees showing the technical traits of the older group, and in a few instances, this was supplemented by latent indifference, disaffection and disengagement. Perhaps of deeper concern was the fact that one or two of the overall CO group had difficulties with basic reading and writing – a reflection of a learning needs issues or earlier weaknesses derived from secondary educational experiences. This led to a series of minor tactics and ploys to avoid situations where NVQ documentation had to be produced. This raised an inadvertent issue of the extent to which the competence framework could be addressed.

Overall, the case points up a number of issues discussed earlier in the argument. There was clear impact of the modernistic commercialisation and marketisation of the company's domain and the effect this was having on the CO's job. On occasion this felt artificial when faced with the realities of particular situations in the field. The marketisation of the company had heightened modernistic managerialist behaviour in the organisation, and the attendant focus on returns to shareholders alienated workers, so relationships between managers and COs had suffered. As a consequence, this rendered the introduction of the NVQ training programme 'yet another thing from management'. The NVQ and the units and elements of the competence standards had to be adapted and applied the CO role. Interestingly, while NVQs are often charged with being insufficiently intellectually challenging or conceptual in depth, the older COs saw the NVQ as being overly intellectual and conceptual and did not hesitate in expressing strong feelings on this. In response, they exhibited powerful empirical and pragmatic behaviour leaning on their prior technical background and credentials as some form of security. However, the competencies of the roles had been (artificially) divided into CO and TO functions so they felt dislocated and alienated from the new role and the competence approach of customer service in the new CO role. Issues around the relationship with NVQs and role identity were also clearly apparent.

14.6 Problems and Opportunities in Relation to Competence Frameworks in the UK Context: Prospects and Possibilities

In summary, it can be noted that competencies (including NVQ approaches) and vocational awards in the UK context potentially offer certain advantages but also have a number of disadvantages. In terms of advantages, competence-based approaches can be seen as:

- Tangibly identifying training needs for employees and managers
- Enhancing selection and recruitment
- Providing a basis of comparison between employees and their individual performance
- Providing a common set of terminology to allow comparison of skills levels
- Providing a benchmark for people to be able to assess their own skills
- Providing a means through which the above micro-improvement actions can lead to an overall macro-improvement in performance and thus organisational competitive advantage

However, conversely, at the same time:

- It is possible that while a competence framework has the ambition of creating a modernistic and positivistically informed systematised and objectified basis of comparison, there is nevertheless human subjectivity in examining, applying and complying with the standards
- There is no guarantee that competencies developed at the individual level will result in competence at the macro-level in terms of organisational performance. Thus competence is difficult to distil to the positivistic linear notion of causality (i.e. cause and effect).
- Often, although not always, in the UK context, competence frameworks are post hoc or retrospective mechanisms in that they look backwards (i.e. they are empirical and pragmatic) at what individuals have achieved and seek to accredit that rather than being developmental tools – this is perhaps more the case with national competence frameworks rather than many organisational frameworks.
- National competence frameworks may seem difficult to adapt to specific organisational or sector contexts.

Thus, while initial optimism in the 1980s and early 1990s was generally high in the UK in relation to competencies and competence frameworks, they have offered only a partial, and at times ambivalent, response to the UK ongoing skills gaps. In particular, key tensions appear to have arisen in the disconnection between interaction and translation of macro-policy schemes and frameworks, through micro, localised, individual and idiosyncratic contexts. This, again, reflects the tensions between the espoused modernistic constructs commonly operating through competence frameworks as opposed to more critical understandings.

In moving forward and considering competencies for the twenty-first century, a number of further factors need to be considered. Over recent decades competencies have played a central role in many government responses and reports to skills gaps and crises in the UK. Indeed, in many regards competencies have frequently been thrust to the fore as a solution. In the UK context, the NVQ framework has for substantive periods provided the lynchpin of policy responses (Roe et al. 2006). However, repeated and politically motivated short-termism in relation to vision, constant change and restructuring of qualification policy and governance has often worked to erode employer, training provider and candidate confidence in NVQs. Moreover, the purported functional government departmental and agency bureaucratic infrastructures that are supposed to underpin them have also been brought into question. Many of the macro-changes purport to target improvement of macro and regional economic performance and industry sector skills. This is ostensibly laudable, but the modernistic rhetoric that accompanies many of these announcements and restructurings is fundamentally positivistic and reductionist in nature and lacks responsiveness to the complexities of the contemporary era. This, in turn, impacts on the potential credibility of NVQ competence framework qualifications, their apparent relevance, applicability and, thus, their ultimate potential benefits.

However, where competencies are not linked with the national NVQ framework, such as, for example, an in-company competence framework, a very different situation exists. In companies and organisational settings where competencies are developed in-house or are acquired from sector bodies or consultancy sources, competence appears to remain a credible, valued and respected part of the employee and management development repertoire. In relation to competencies in the UK, such postindustrial landscapes will potentially require the potential to multiskill and have the possibility, and indeed necessity, for employees to be able to move between and across role and job boundaries and competencies (Rice 2007; Noordegraaf 2000; Lavie et al. 2010; Birkinshaw and Gupta 2013; Shaw 2014). In their conventional and contemporary form, competencies, especially within UK NVQ frameworks, have been informed by, and couched in, the strictures and delineations of modernist philosophies and structures. In this sense, competencies may need to be rethought in order to accommodate emerging atmospheres and environments. Thus, the transformation of many sectors of the UK economy has led to a substantial change in boundaries and delineations of roles, industries and identities. Williams (2013) in relation to the transforming face of requisite competencies points at the emergence of the notion of, and need for, 'boundary spanners' in organisations. These require a novel set of competencies to deal with the challenges of twenty-first century working life:

> The role of the dedicated boundary spanner is an assembly of reticulist, interpreter/communicator, co-ordinator and entrepreneurial components, each associated with a particular mix of competencies, and these are also evident in the practice of other actors who engage in boundary spanning management (Williams 2013: 25–27).

Competencies have often grown up within a given industry construct and set of needs. This industry approach has been common in recent decades and is liable to

be reinforced by the establishment of sector skills councils and various industry associations. In this vein, Busch (2013), discussing competencies in front-line sales contexts, also points out a role for developing cross-sector competencies. The blurring of boundaries is a symptom of a more complex and messy strategic world (Stacey 2012). Indeed, Tapper (2013: 6–8) talks about the need in the European context for a set of competencies that provide a capacity to 'deal with ambiguity'. It is certain that many of the more seemingly fixed and long-standing structures and boundaries appear to be in flux and negotiation.

As noted above, the UK, more than most European economies, is extensively marketised and privatised, and this applies equally to training and development. There are many independent training providers involved in delivering various competence and competency frameworks. While UK government policy and rhetoric cultivates and disseminates the message of rising education and attainment levels and skills for all, there is nevertheless a 'reality' that the delivery of competence frameworks is a significant and profitable *business*. The marketisation and commodification of competence-based training may be as much commercially as pedagogically driven (Jordan and Strathdee 2001). On the other hand, a market in competence-based training potentially also places power in the hands of individuals in the labour market. This affords employees and workers the opportunity to build up a qualification profile offering social and professional mobility. New and evolving forms of CVET qualifications and competence frameworks may therefore continue to play a highly significant role in shaping the twenty-first century job market.

The above issues of commodification are linked with a further point that many of the changes and transformations in government and training agencies and infrastructures witness the same group of well-known faces moving around roles in pursuit of careers within reshaped training networks. While this may, to some extent, be anticipated as accumulated and aggregate industry expertise, it does also potentially mean that the vocational training networks can, at times, appear to be self-perpetuating and self-serving in character within a given geographical area. There is perhaps scope for innovation and novelty (certainly in the NVQ market) which risks becoming rather jaded. Free-market mechanisms may address this issue, but as long as government agencies play an important role in competence-based training, it is unlikely to change and this could increasingly emerge as an issue.

Furthermore, social class divisions which have emerged between vocational/competence-based qualifications and degree-based qualifications continue to be a tension in the UK. There is a strong risk that competence-based approaches (and especially NVQs) will be definitively relegated (if indeed it has not already occurred) to the qualification for the lower socioeconomic groups of British society. With the expansion of higher education, this situation is only likely to be reinforced. The challenge and difficulties in increasing participation in university education of disadvantaged groups only serve to reinforce NVQs as the qualification of lower standing because NVQs are often presented as an alternative for the less academically inclined. Although there has been a substantial expansion of higher education and

consequent increase in graduates, the UK's historical propensity to value the pragmatic, empirical and experiential means that vocational and competence-based approaches to training may ironically and strangely remain valued over simply intellectual achievement (Stokes 2008).

The issue of social divides surrounding NVQ and degree-level qualifications is interesting to consider as new generations with potentially alternative values start to pass through education systems into workplaces. Generation X (post WWII baby-boomers) launched competencies in a world that needed to transform and adapt to new technologies. Generation Y (born 1980s and 1990s) and Z (born post-millennium) are likely to approach competencies, NVQ or other, in different ways to preceding generations (Blakely 2014). In the era of Internet and social media, there may be an increasing role for simulation in relation to the training, development and assessment of competencies. By way of illustration of this *Brave New World*, Nimmagadda and Murphy (2014) provide an example of the use of simulation in relation to social work contexts. Simulation is a realm that offers a potentially vast fresh range of complexities for the management of competency frameworks. Linked to these new vistas, there is perhaps also scope to use competencies in, for example, *predictive* manner as well as to assess retrospectively acquired skills: 'There needs to be a greater role for 'predictive managerial competencies' (Dainty et al. 2004). This may mean a transformation in the historically bound empirical retrospective approach to competence. It may involve the adoption of some of the continental idealism and visionary perspectives and a shift away from British pragmatism and empiricism in relation to skills and competencies.

Moreover, the transformation of the UK economy and social fabric has included the rise of the entrepreneur and entrepreneurship as a means of adding value to the economy. Entrepreneurs are often celebrated for their success and wealth creation, often despite earlier poor academic performance, a story that accords well with the experiential and anti-intellectual strands of UK culture (*Economist* 2011; Rooksby 2012). As Chell (2013) underlines, if entrepreneurialism (and intrapreneurialism – innovating within an organisation) is a key dimension of the twenty-first century work environment, then the skills and competencies that comprise such behaviours and dispositions will need to be redefined and applied.

In summary, work on competencies over the last several decades, and across a range of fields and industries, has made a degree of progress in addressing a move beyond a disparate qualification framework and a predilection for functionalistic and managerial approaches. This has involved an attempt to embrace more relational, human, personal and overall subjective and contextual factors that reflect the emergent complexities of this new epoch. A fusion of more sociological approaches and an attempt to move competencies away from their modernist roots seem worthy of consideration (Bardzil and Slaski 2003). Such evolutions may even see a role for the fusion of competencies with, for example, narratives and storytelling in order to challenge the hegemonic dominance (Gabriel 2000, 2004; Czarniawska 2004) and link this to NVQ competence assessment techniques. All of this is likely to be encompassed within an environment of simulation and social media.

Evolving generations may also induce broad transformations and transitions in modernistic, empirical and pragmatic mindsets and the instigation of fresh views and approaches which will have inherent consequences for competence frameworks.

14.7 Conclusions

In conclusion, the last several decades has seen extensive and widespread effort invested in the notion of competence and competency frameworks in the UK. Whether competencies continue to have a future in UK settings will depend on their ability to adapt to the emerging and transforming paradigms, atmospheres and environments. In the immediate future, there will be a need to acknowledge that the modernistic hegemony that shaped competencies during the first 50 years of the cultivation of the sphere is shifting to a more complex, chaotic and messy world of global shifts and rapid technological and innovation. Equally, it is hard to determine to what extent British pragmatism and empiricism will continue to be a major part of the national psyche and the way in which this will negotiate the changing class and socioeconomic terrain of the UK. The fusion of modernistic approaches with more sociological, subjective and critical approaches and paradigms is already underway. Its trajectory will be fast-paced and rapidly changing.

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Chapter 15
Competence Development and Workplace Learning: Enduring Challenges in the Interplay of Policy and Practice in the UK

Karen Evans and Natasha Kersh

15.1 Introduction

Ideas about what constitutes a knowledge-based society are in flux. A conception of a knowledge society that combines the arguments for knowledge-based economies in Europe with wider notions of a learning society has been strongly related to the development of workforces equipped with high levels of competence (European Parliament 2006). The changing abilities required for contemporary working life present organisations and individuals with a number of challenges that, it is argued, can be met only through lifelong competence development. Developing competence has become crucial both for a sustainable working life (Evans et al. 2013) and for the organisational development of workplace environments. The latter has engaged UK researchers from a variety of traditions (e.g. Eraut 1994; Remedios and Boreham 2004; Evans et al. 2006; Fenwick 2006). European agendas since 2000 (European Commission 2000, 2001) have repeatedly emphasised the significance in modern societies of human capital, lifelong learning and work. In response, the driving force behind most member states' policies has been concerned with employability and adaptability to economic shifts and demands (Zarifis and Gravani 2014), where the competence development of individual workers is expected to play a crucial role. At the same time, there is a strong critique of this position, as Zarifis and Gravani (2014) show in comparing the actualities of lifelong learning with the intent of the EC Memoranda. In the present time, self-sustainability is increasingly emphasised, as a goal which extends beyond employability, and the discourses of innovation move beyond adaptability towards creativity, developmental competence (Ellström 2001) and the reshaping of work practices.

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The nature of competence and its various configurations, as well as the contexts where it could be developed and exercised, have become important areas of research. Because of its complexity and strong dependence on the context where it is applied, the concept of competence has been interpreted and conceptualised in a variety of ways (see Part I of this volume). The meanings given to competence in everyday life, in both vocational education and training settings and in academic settings, are quite different. What is more, the meaning is likely to change over time within each of these contexts. We will start by considering the idea of competence development as used in occupationally related education, training and assessment, outlining policy and practice tensions in the introduction and development of the competence frameworks adopted in the UK at national (systems) levels. This chapter will give particular attention to competence development in the workplace, which is strongly influenced by the quality of work-related environments and organisational dynamics. We will consider the ways in which competence development in the workplace is associated with a range of motivations at the individual level and also look at changing perceptions of the learning space at work. These factors are shaping the realities of the development of competence and the challenges for workplace learning in the United Kingdom, at the levels of policy and practice.

15.2 Competence-based Education and Training: The UK National Context

Approaches to competency-based education and training have to be understood not only in terms of the need to develop and update skills in changing work environments but also in terms of the impact of different conceptions of competence on learning (Velde 1999). The emergence of the 'competence movement' in British education and training in the 1980s and 1990s is significant for understanding both the modern concept of competence and the nature of the National Occupational Standards. It is also important for an understanding of the debate over the different versions of the concept of competence that are in play in Europe and the extent to which these might be converging. Early developments in defining standards in the UK focused on task analysis (not so much on competence). Standard tasks were replaced by competence objectives in 1986, with the 'Review of Vocational Qualifications' (MSC/DES 1986), when the NVQ criteria were first published and the term 'competence' was adopted (Stewart and Sambrook 1995). The review was a significant step, especially as it recommended a new qualification framework and development of standards. Further developments have led to the adoption of the version of competence that has become dominant in the qualification frameworks in use in all countries of the UK, in which competence has been defined as the ability to perform work activities to the standards required in employment (NCVQ 1989). The contrasts between this view of competence and the versions with a more generative view of people's capacities that are dominant in France, Germany,

Netherlands and Sweden have been extensively discussed by Brockmann et al. (2008) and Mulder et al (2007) (see also Chap. 17 of Le Deist, Chap. 16 of Weber and Achtenhagen and Chap. 25 of Wesselink et al., in this volume). The main features of competence frameworks introduced in Britain included tight prespecification and subsequent measurement of the intended consequences, or 'outcomes', of learning. 'Functional analysis', which became an underlying principle of the development of the standards, has been defined as (1) the process of deriving competencies for particular occupations (Bates 1995) and (2) a central feature of the methodology to implement government policy on NVQs in England (SVQs in Scotland) and for producing statements of national standards (Stewart and Sambrook 1995).

Britain embarked on a bold experiment with competence-based education and training, in setting up its framework of National Vocational Qualifications (NVQs). This experiment attracted much interest around the world. Ten years after a national review of vocational qualifications led to the establishment of the National Council for Vocational Qualifications (NCVQ) to coordinate them, there was mounting pressure for a fundamental reappraisal of the framework and its appropriateness for the changing world of work in the face of evidence that some fundamental changes of approach were needed (Beaumont Report 1995). The development of the British system can be analysed in four stages:

Stage 1: 1981–1986. The 'New Training Initiative' launched a three pronged approach to improve the quality and quantity of training in Britain. This involved guarantees of 1-year vocational preparation for all school leavers, new kinds of occupational standards and move away from time serving in vocational training, and wider access for adults to education and training for employment. Government schemes, particularly Youth Training Schemes, were used as test-beds for the development of these 'new kinds of standards'. As work-based funded programmes operating under government guidelines, these were regarded 'soft' areas in which new approaches could be piloted without the prospect of significant resistance or industrial relations issues arising. Standards trialled were based on work-based performance and 'standard tasks' derived from analysis of the key functions.

Stage 2: 1987–1990. The National Council for Vocational Qualifications was established with the purposes of rationalising the 'jungle' of vocational qualifications (which had proliferated under the entrepreneurial examining and validating bodies such as City and Guilds, BTEC, etc.) around these 'new standards'. A five-level framework was designed with the intention that individuals could progress to levels up to postgraduate equivalent by any mode of learning, including work-based learning m the workplace. Underlying this agenda was a set of values which privileged 'work-driven' over 'education-driven' approaches (Hayes 1983) sparking critiques that the government had embarked on an ideologically driven project that was intended to put employers in the driving seat and marginalise the education sector as providers.

In 1986 the government initiated the definition of national standards for employment and a system of national vocational qualifications by establishing the National Council for Vocational Qualifications. To be accredited as a National Vocational Qualifications (NVQ), a qualification had to be

> based on national standards required for performance in employment and take proper account of future needs with particular regard to technology, markets and employment patterns; based on assessment of the outcomes of learning, arrived at independently of any particular mode, duration or location of learning; awarded on the basis of valid and reliable assessments made in such a way as to ensure that performance to the national standard can be achieved at work; free from barriers which restrict access and progression and available to all those who are able to reach the required standard by whatever means; and free from overt or covert discriminatory practices with regard to gender, age, race or creed and designed to pay due regard to the special needs of individuals.

Stage 3: 1991–1994. The Framework of NVQs was extended to include GNVQs (General National Vocational Qualifications) to meet the demand for a more generic approach to vocational preparation which could be pursued in full-time education.

Stage 4: 1995–1998. Increased resources were given to the development and marketing NVQs, tied to meeting of national education and training targets. The latter were framed in terms of the proportion of the population to reach specified levels by certain ages and also the terms of lifetime learning targets. A massive programme of implementation was set up to achieve these targets as evidence mounted of some inherent weaknesses in the approach and of practical difficulties in its implementation. The issues arising can be considered under three headings: practical issues, conceptual issues, and quality assurance and accountability issues.

15.3 Challenges Arising in Early Years of NVQ Implementation in Britain

Practical issues associated with the implementation of the competence-based approaches in NVQ were access and participation, the ability of employers to deliver work-based assessments to standards, complexity and consistency and proliferation of awarding bodies. It was estimated by the NCVQ that 85 % of the workforce would have 'access' to National Vocational Qualifications in 1995, based on the number of occupational areas in which awards are available. It did not reflect the actual take up, which was initially very low. Many awards had been developed at high cost in areas in which there was little demand, many employers preferring to use existing and established training programmes instead. It was estimated that in 1995 two million people were 'working towards' National Vocational Qualifications, approximately 8 % of the workforce. The figure was misleading as the initial indication was that many of these were completing only units of programmes and were not expected to progress to the achievement of the full vocational qualification. On the

second challenge of the ability of employers to deliver work-based assessments to standards, the complexity of NVQs was a central issue for employers. Each 'area of competence' was broken down into numerous elements, which required assessment to workplace occupational standards defined by 'lead bodies'. Each was accompanied by 'performance criteria', 'range statements' and 'knowledge specifications'. Employers had to be committed to this process to accommodate NVQs, sustain them and meet the requirements for assessment. Obviously larger firms were in a better position to be able to do this than smaller firms. In the early years, up to half of firms with more than 500 employers were using National Vocational Qualifications in one form or another, although many of these were confined to particular occupational areas, and large employers were as vocal as others in their complaints about the burden of assessment involved. At that time fewer than 10 % of firms with less than 50 employees were using NVQs. The nonusers tended to be the companies which had historically low involvement in training, the very companies whose needs were meant to be addressed by the new national system. Small employers found they were unable to provide significant parts of programmes because they did not have the relevant areas of activity in which trainees need to be assessed, and it was often too burdensome for them to arrange such experiences. Complexity and consistency presented further challenges. The difficulties encountered by employers were compounded by the large amounts of paper work involved in the administration of NVQs.

Any approach which assesses performance of numerous disaggregated tasks requires numerous assessors and verifiers. Accompanying bureaucracy and 'form filling' become a major disincentive in the NVQ system. The language surrounding the operation of the scheme also becomes something of a barrier. Commonality of language and descriptors and the reduction of jobs into standard tasks and functions do not, in practice, achieve consistency of standards between providers in the way often claimed. The ways in which tasks are interpreted and implemented in different sectors and different types of organisation are widely variable. It quickly became apparent that tasks and standards were not going to be interpreted in the same way in the corner shop as they are in a major international store, nor in the privately owned local garage in the same way as in a multinational company. Moreover, multinationals were looking to international standards, and there was scepticism about whether the approaches of NVQs could deliver 'world-class' standards in their original form. The proliferation of awarding bodies added to the problems. While levels of awards had been simplified and the scheme made it possible, in theory, to equate any given award with a level within the framework, in fact the number of bodies which could award these NVQs multiplied. This combined with the lack of consistency of standards meant that the initial, central objective of this policy, namely, the simplification and establishment of common standards and easily understood qualifications, was far from being realised. The response of the National Council of Vocational Qualifications argued that, with more effective marketing to employers, the qualifications would be more readily understood and the barriers to their take up will be reduced. A decade after the introduction of NVQs, it was

recognised that the issues were of substance rather than of presentation and that they would not be resolved without a fundamental review of the framework and approach.

Turning to conceptual issues, those that generated most debate included the problem of equating competence with performance, the relationship between learning and performance, process and outcomes, assessment of knowledge and understanding and the place of core skills. More fundamentally, did approaches based on functional analysis of tasks prepare people for the jobs of the future or reflect the jobs of the past? And how could an approach based on task analysis be extended to higher-level NVQs in the professions?

The extent to which competence can be equated with performance was hotly debated among practitioners and professional bodies. This debate revealed the differences between the underlying traditions that have influenced the development of competence-based education since the middle of the last century: the behaviourist, the generic and the cognitive (Mulder et al. 2007). Each of these three traditions indicates a direction for considering the concept of competence from different perspectives and for different purposes. The *behaviourist* approach stresses the importance of observing successful and effective job performers and determining what differentiates them from their less successful counterparts. The *generic* approach is more concerned with identifying the common abilities that explain variations in performance. Finally, in its conceptualisation of competence, the *cognitive* approach draws on all the mental resources of individuals that are used to master tasks, acquire knowledge and achieve good performance. Although this categorisation does not provide a universal topology for the notion of competence, this framework is helpful as it brings our attention to the changing nature of the use and interpretation of the concept of competence. The approaches initially adopted by the National Vocational Qualification framework were behaviourist approaches which were based on functional analysis or the breaking down of jobs into functions and tasks. The behavioural approach is, by its nature, reductionist and becomes very elaborate. Disaggregating the elements of performance of a job into its parts makes the assumption that these can be reintegrated into a statement of competence in the performance of whole jobs and roles. Having started at the most 'simple' level, the elaboration and extensions of the NVQ approach to incorporate the features of roles and jobs at higher levels made a complicated framework even more complex and ran into much resistance. It could be argued that the appropriate starting place for the framework would have been a set of generic competencies – that is, broad clusters of abilities which are conceptually linked in some way and which are called upon in performance of roles and activities – which could encompass the whole rather than trying to build up the framework from the simplest level of performance of tasks in basic occupations.

The relationships between learning and performance also had to be reexamined in terms of process and outcomes. The NVQ framework is predicated on the notion that it is the outcomes of learning which determine the qualification, and these will be credited irrespective of the learning which has taken place: it does not matter how or where you learn it; if you can do it, then you should be credited with it. While there are benefits in recognising the outcomes of learning in a way which is not

dependent on a particular mode and duration of attendance, process and outcome in learning are intimately linked and cannot be divorced without some negative effects and consequences. There are links between any activity, the context in which it is undertaken and the skill or concept being learned. The argument for an entitlement for all learners to a certain quality of learning process proved powerful, when allied to evidence that quality of process is likely to be reflected in outcomes. For example, minimum training times cannot ensure that the trainee or learner requires depth of understanding and experience, not only of the specific tasks but also of the social environment and expectations of the roles. While time serving had many wasteful and inappropriate aspects, the apprentice did learn from the 'master' and from experienced workmates the expectations and relations of the workplace and pride in the work of the craft person. This came to be recognised in the development of the UK 'Modern Apprenticeship' which added to the basic NVQ occupational standards, a supporting, broader curriculum incorporating additional areas of knowledge and core skills as essential parts of the programme. The question of how knowledge and understanding were to be assessed was the next controversy. It was a feature of the initial NVQ framework that underpinning knowledge can be inferred from competent performance and should not be the subject of a separate assessment. This too was an impediment to the acceptance of NVQs at the level of professional qualifications and higher education, where the knowledge base is extremely important (Hodkinson and Issit 1995). Employer bodies and providers also recorded concerns that the approaches are not effective in developing or verifying the existence of an integrated understanding of underlying principles. Any programme which does not develop understanding of underlying principles runs into two problems. First of all the qualifications are not future oriented. An inadequate knowledge of underlying principles limits capacities to respond to unpredictable situations. A parallel problem is that of safety, one uppermost in the minds of professions such as electrical engineers, which were vocal in presenting their concerns about NVQs in the 1990s. A worker faced with an unusual situation or set of circumstances needs to be able to make decisions as to how to operate with reference to underlying principles. There is a real danger that approaches which seek to infer the understanding of principles by assessment of the performance of disaggregated tasks will miss the point. The challenges of gaining acceptance for NVQs within the frameworks of vocationally oriented higher education multiplied in the light of these considerations.

Vocationally oriented higher education was responding in its own ways to the changing work contexts, with flexible forms of provision and partnerships with professional bodies. Resistance among the educational community to perceived narrowness and ideological intent in the rapid adoption of an untried system was matched by deep expressions of concern from business leaders. The Times 'Higher', on 17 October, 1995, reported continuing 'severe criticism from the business community' (Times Higher 1995). Dominic Cadbury, chairman of the Confederation of British Industry's Education Committee, said that 'the NVQ remains too costly, too bureaucratic and too much geared to larger employers who have the resources to turn it to their advantage'. A report by the Employment Policy Institute (1995), in the same week, showed again that employers did not want people with narrowly

based vocational qualifications, but were better served by improved general education of the workforce than by a proliferation of narrow vocational qualifications.

A broadening of understanding about what counts as competence and the significance of the quality and depth of learning in achieving it was necessary before these competence-based approaches could be accepted at higher education and professional levels or for safe practice in lower and intermediate skills. Broader classifications of competencies developed which essentially comprised distinctions in the scope or level of aggregation of descriptions of competence (Oates 2004). Oates, a prominent representative of the professional and assessment and validation communities, explained how competence emerges as an inferred quality of a set of capacities which allow complex decision-making and action in diverse settings. The development of these capacities takes time, immersion in rich learning environments, guided reflection and a complex interaction of theory and practice – both in meeting occupational standards and maintaining effective work performance.

By the 2000s learning outcomes were being widely adopted in higher education, following the Dearing Review on Higher Education (1997), to cover the outcomes of educational programmes together with developments in the Accreditation of Prior Experiential Learning (APEL) to cover assessment of informally developed knowledge and abilities. These developments were relevant for both academic and vocational programmes, and a learning outcome approach enabled broader competence-based approaches to be accepted into many higher-level educational courses, with the validation of outcomes subject to quality assurance regimes that were to ensure that depth and quality of learning experiences substantially contribute to the defined intended learning outcomes, which had themselves to become more broadly drawn. In employer-based training using NVQs, some of the concerns about narrowness were met through the broadening of competence-based assessments to include substantial elements of underpinning and related knowledge. There were renewed calls for improvements in the quality of environments for learning at work to support these developments (see Unwin and Fuller 2003; Evans et al. 2006). More generally, positive longer-term consequences of these developments and the debates they generated were also apparent. Learning and competencies acquired outside formal education had been brought to wider attention and given credibility by the development of NVQs that define and describe vocational competence, which is assessed by outcome. Where the time, place and context in which the competence has been gained is held to be irrelevant to the assessment of the competence, gaining credit for past learning and achievements becomes a real possibility.

Strengthened by a development process that both broadened and deepened NVQs since 2000, the central principles underlying UK approaches to competence development have endured. The principles (a) that the means and outcomes of learning can be separated and (b) many learning outcomes can be achieved through workplace and informal learning and can be validated for accreditation purposes are embedded in the Qualifications and Credit Framework (QCF). The European Qualifications Framework, which describes competence in terms of responsibility and autonomy (European Commission 2008), emphasising proven knowledge and abilities in work or study situations, is often described as a translation device,

allowing equivalences between national qualifications to be explored. Yet it is important to keep in mind that this exploration is critically dependent upon the different interpretations of the concepts of competence and qualification that are dominant in different countries, as the breadth of the OECD discussion (Ananiadou and Claro 2009) has shown.

15.4 Workplace Learning and Competence Development

The UK policy agendas of the past 20 years have reasserted the central role of workplace learning for workforce competence development. *The Learning Age* (DfEE 1998) *Skill Strategy* (DfES 2003), successive reviews of skills policies (DBIS 2010) and, in Scotland, *Life Through Learning; Learning Through Life: Scotland's new lifelong learning strategy* (The Scottish Executive 2003) are just a few examples of the increasing prominence given to both adult learning and the workplace as an important site of learning at the start of the twenty-first century. The significance of the link between education and training provision and employers' demands for skills was repeatedly emphasised (Unwin and Fuller 2003: 2), with calls for greater attention to boosting the 'demand' side in the supply and demand for skills and knowledge at work. More recently, the Commission on Adult Vocational Teaching and Learning (2013) initiated a fundamental debate in England as to what we value and hold in high esteem in the world of work at a time of harsh economic conditions, specifically emphasising the need to create a consistently strong system of vocational teaching and learning. The perception of the workplace as a site only for work and organisation-specific training is gradually changing, as workplaces are recognised as sites for learning in various configurations, contributing to lifelong learning, personal development and social engagement of individuals (Evans 2009). Competencies that employees develop and exercise as a result of engaging in a range of work-related activities, both formal and informal, are integral to workplace learning. The recognition of these competencies through competence-based programmes and qualifications has been shaped through processes of policy formulation and contestation and the policy-practice interplay. Illeris (2011) has observed this tendency internationally, in the gradual transformation of the role, use and perception of the notion of competence and in the way it has been used to contribute to better understanding of educational contexts, working lives and individual achievements.

Such competencies in the UK continue to be validated and assessed in the workplace environment on the basis of clearly defined criteria of success, on the basis of National Occupational Standards, set by the appropriate Sector Skills Council or sector body. In this context, competence has been described as the behaviour, knowledge and values expected of workers to fulfil a specific role competently. Further debate on work-related competencies highlighted the significance of the personal competencies and abilities that people can use in a variety of settings, including workplace settings (Evans et al. 2006; Eraut 2004). The idea of transferable

competencies sparked much development and debate as UK formulations of core skills, basic skills and generic skills started to proliferate in the 1980s and 1990s (Evans and Brown 1986; Oates 2004) and were held to be of crucial importance for young people entering the contemporary workforce. Employees at all levels are now expected not only to be able to exercise occupationally specific competencies in their job roles but also to possess a range of skills and attributes that are relevant for effective working in different contexts and settings. At the same time, traditional definitions and explanations of professional competence or expertise that have been based on theories of technical rationality, on the basis that learning can be applied in predictable ways, have given way to explanations of professional expertise which emphasise the importance of future-oriented capabilities (Eraut 2007) and the exercise of judgement (Beckett and Hager 2002).

The redefinition of the term 'competence' offered by Eraut and Hirsh (2007) emphasised the important links between individuals' capabilities and their competencies. All their competencies will be, as Eraut and Hirsh (2007) explain, within their capability, but not all their capability will be needed for any specific job. Therefore, individuals will have *additional capability*, which may have a tacit dimension. Such additional capabilities may be helpful both in enhancing one's competencies through further learning and also, according to Eraut and Hirsh (2007), in facilitating the process of transferability of competencies between various contexts and settings.

The discussion on understanding work-related skills required by new workspaces has underlined the importance of gaining a better understanding of how knowledge and competencies are used and developed as people move between different contexts and settings, including both workplace and other life and work contexts in which significant learning takes place. As Boud and Garrick (1999:1) have observed, employees develop skills of expression and communication which spill over into their personal lives. They also learn new ways of collaboration and planning which they can bring to their roles in their families and communities.

While the metaphor of 'transfer' has been dominant in recent times, the current debate has extensively problematised this notion (see Hager and Hodkinson 2009) which often pays insufficient attention to the learning processes involved in recontextualising skills and knowledge in order to 'put them to work' in new and changing contexts (Evans et al. 2010, 2011). In this context, the role played by tacit skills (Evans et al. 2004) and by self-management (Bound et al. 2014b) has been fundamentally linked with capabilities to use skills and competencies in a range of settings and spaces.

As Felstead and Jewson (2012) point out, a common set of skills characterises those who successfully adapt to a range of new working spaces. These include, for example, motivation, self-discipline and the ability to establish and maintain boundaries with others to achieve targets without immediate supervision. Acquisition of such skills, as Felstead and Jewson (2012:155) point out, represents a major contribution to the underlying learning dispositions of employees, as new spaces of work demand new models of self-governance. Examples from the field of nursing are provided by Allan et al.'s (2015) research into the capabilities required of newly

qualified nurses as they are held accountable for the delegation of care to healthcare assistants. By contrast, in the cultural and creative industries, free lancers are shown to be engaged in the reproduction of the self as an economic resource, relying on capabilities such as the ability to read situations quickly and on effective use of networks (Bound et al. 2014a).

The interplay between competence development and workplace learning is also strongly reflected in public policy-driven attempts to enhance employees' literacy, numeracy and information technology (IT) competencies. The context of the contemporary workplace presupposes that employees have satisfactory levels of English and Math skills, as one of the crucial requirements for engaging in a wide range of work-related tasks and activities. The public policy agenda which resulted in the setting up of 'Skills for Life' courses (DfEE 1999) as well as other types of formal and informal provisions across all sectors of the economy and public sectors in England now emphasises the functional skills of English and Mathematics as most recently represented in *Rigour and Responsiveness in Skills* (DBIS 2013).

Research undertaken across different occupational sectors in a range of UK workplaces (including, e.g. care homes, Fire and Rescue Service, ship building) has indicated ways in which employees are expected to use their literacy and numeracy skills more intensively now than in the past, within many occupations, including job roles that are traditionally considered to be low skilled and low paid (Kersh et al. 2012; Waite et al. 2014. For example, in the employment setting of a care home, care workers commented that they are required to have the competence of being able to complete daily forms that relate to various aspects of the daily routine of those in their care. The significance of language that they need to use while filling in these forms has been emphasised: it needs to be clear, concise and professional. Employees of the Fire and Rescue Service (firefighters) have described the competencies required for their job roles as a combination of occupationally specific, personal and basic skills, with both literacy and numeracy playing a significant role. The ability to undertake calculations while performing their immediate duties, often under pressure (e.g. exact timing of rescue operations), is regarded as a prerequisite of their professional competence, as well as producing detailed and comprehensive written accounts of rescue operations. Such requirements present a challenge for some employees, and various forms of work-based provision and courses are expected to play a crucial role in addressing this challenge.

However, research has indicated that the government-initiated schemes, such as Skills for Life provision, have encountered range of problems resulting from tensions between policies and practice. Waite et al. (2014), for example, note that the pressure of adapting courses to shift patterns, diverging priorities of providers, training managers and line managers, changes to companies and the impact of the economic downturn has presented major barriers to sustainable provision. What is more, government declarations of a 'skills crisis' based on assumptions about the existence of large-scale deficiencies in literacy and numeracy skills among lower-level employees have taken insufficient recognition of the variation of literacy practices among lower-level employees in differing organisational contexts as well as the complex constitution of employees' skills and competencies (Waite et al. 2014).

This body of research (e.g. Evans et al. 2011) has indicated that the workplace programmes designed to develop literacy, numeracy and IT competencies have often been associated with a wider range of personal and professional outcomes for the employees than were envisaged by the organisations who entered the publicly funded programme. Enhancing basic skills through workplace learning can encourage employees to develop their competencies (personal or professional) further, as Taylor and Evans (2009) have shown.

While much attention has been paid to ways in which adults can be supported to develop their competencies through workplace activity, less attention has been given, until recently, to the pedagogic strategies that promote competence development through the interplay of college-based and workplace learning, including the pedagogic strategies that can effectively bring together subject-based and work-based knowledge in programmes at the higher vocational levels. Gradual release is one such strategy, identified in Evans et al. (2009) research into 'Putting Knowledge to Work', exploring processes of knowledge recontextualisation in competence development. The principle of 'gradual release' involves recognising different forms of knowledge that are constitutive of competence and sequencing the knowledge elements of learning programmes in ways that support learners in moving between learning, practice and workplace environments via the gradual, iterative release of responsibility from educator, trainer and supervisor to learner. The exercise of responsibility by individuals and in teams is strongly influenced by attitudes, motivations and dispositions to act in particular ways in response to opportunities or difficulties that arise in day-to-day work (Garrison 1997), as well as workplace environments and cultures. Accordingly, particular contexts, work settings and productive systems may either facilitate or undermine employees' competence development within the workplace.

15.5 The Role of Motivation in Adult Learning and Competence Development

A significant body of research literature (see Malloch et al. 2011) draws attention to the role of the workplace context and its distinctive relationships with individual motivations, experiences and outcomes. Workplace affordances and the extent to which employees are motivated to engage in learning opportunities that are available to them facilitate knowledge sharing and competence development at work. What employees learn as participants in the workplace is related to their dispositions, motivations, attitudes and to what they perceive as being in their interests as workers, translating into a great variety of responses to workplace affordances for learning, which themselves range from learning-rich to learning-poor, expansive to restrictive (Fuller and Unwin 2004). A number of studies have approached the competence development through the avenue of understanding what motivates adults to develop their competencies in and through the workplace (Evans et al 2006;

Edwards et al. 2006). Indeed, some psychological studies have equated competence with performance motivation (after White 1959) (see for a summary of his work Mulder 2014) and have therefore construed motivation as integral to competence. Previous research has identified a range of motivational factors that may stimulate learners towards engaging in workplace learning. Factors such as personalities and backgrounds, previous educational and life experiences, age, gender and attitudes to learning have been considered as enablers or barriers for competence development. Motivational dispositions have been held to be integral to self-management in learning (Garrison 1997) and need to feel competent as integral to intrinsic motivation (Ryan and Deci 2000). Carré (2013) has identified eight heuristics that take into account the major roles of motivation, self-regulation and capabilities as three conditions for adult learning, looking for learning interfaces between learners' dispositions and environmental resources as a key to efficient, learner-oriented instructional design.

The emergence of workspaces where the boundaries between work and learning are considerably blurred is exerting new influences on employees' motivations and the processes of competence development. Research (e.g. Brooks et al. 2012) suggests that the perception of the workplace space plays a significant role in facilitating or undermining employees' opportunities for competence development as well as their motivations towards the acquisition of a range of skills and their engagement in the social practices of work. Different types of learning space may play a significant part in enhancing the learning processes and aspirations of new entrants and experienced adults, as well as developing confidence in the workplace. The learning space at work can be perceived as a combination or overlap of a range of components, such as physical space, learning contexts and environments, formal/informal learning and virtual learning.

To take an example, in innovative aircraft maintenance engineering degree programmes, the hangar experience allows the students to extend their skills through participation in a range of activities. Some activities are more formalised than others. On the informal side, supervisors reported extending 'invitational' opportunities to the students (Billett 2006). One supervisor gave an example of how he simply gave time to students and took an interest in them as future engineers: 'If I see them in the hangar I talk to them, ask them who they're with, how they're getting on – these are our people of the future'. Another supervisor recalled how he creates opportunities to 'get students involved' in whatever he is doing: 'if I'm doing some plating or working on nose-loading gear then I get them involved'. He also emphasised involving them in the thinking behind the activities, as in 'It's about jointly assessing the job, planning it, what tools needed etc and getting on with it'. In these ways, everyday working practices are turned into learning opportunities for competence development.

The expansion of new technologies, such as the Internet, email, mobile phones, etc., has an impact on competence development in the new types of learning spaces. Research in UK companies (Kersh et al. 2012) has explored the challenges of so-called virtual environments (e.g. via electronic resources), where employees' digital competence becomes of utmost significance. While learning at work, employees are

increasingly expected to acquire and employ digital competence. There is a growing tendency for online 'paperwork' and administration, where employees need to be computer literate. Employees were strongly motivated towards digital skill development if they felt that their newly acquired IT skills could be applied immediately within their workplace settings. In the Fire and Rescue Service, for example, firefighters acknowledged that being digitally literate enables them to perform their jobs better, while they use various types of electronic record/note-taking devices (e.g. via mobile phone or tablet). Engaging in different types of virtual learning has motivated them towards further learning and competence development. In a large hotel and restaurant group, collaboration with a provider of technology-enabled learning services has led to the creation of virtual learning opportunities through an Elbox device, a touchscreen tablet PC, which enables anywhere, anytime access to learning for employees. The concept of virtual learning that has been associated with the expansion of digital technologies broadens the notion of the learning space and contributes to erasing the borders between different types of learning site and enabling the interplay of instruction and experience that is necessary for competence development.

15.6 Conclusions

Competence development in the workplace is a complex process that is strongly influenced by the interplay between nationally recognised regulatory frameworks, workplace environments and the attitudes, dispositions and motivations of workers. While supporting structures for VET are provided through formal educational institutions, regulatory frameworks that govern employment, business systems and licences to practice in particular occupational fields influence the organisations in which people work, contributing to an environment for learning that can be rich, poor or uneven in quality. Work systems in different countries are characterised by contrasting ways of structuring tasks and jobs and of controlling how work is allocated, performed and rewarded. Employment relationships are also linked to the nature of firms, interest groups and dominant governance principles or "rules of the game" in different societies, which in turn stem from different patterns of industrialization. Whitley's (2000) argument that the radical transformation of any prevalent system in any society will be limited by the extent to which work system characteristics are integrated with the institutional arrangements which are themselves rooted in different patterns of industrialisation is borne out by an examination of the introduction of, and resistances to, competence-based and credit transfer systems for education and training in different national contexts. In the UK, where the NVQ system was initially directly targeted at workplace learning and the participation of employers is voluntary, the effects upon learning environments and learning outcomes have depended largely upon local circumstances, and the extent to

managers, trainers and trade-union representatives perceives the need to work together to enhance workplace learning (Rainbird 1990). Outcomes have also depended on the corporate strategy and the organisational terrain it provides for employee development and on whether the NVQs have been used as 'containers' or 'enablers' of competence development for workers (Evans and Germon 1993).

Competence development programmes implemented in the workplace are likely to be more effective when learning is seen as an integral part of practice rather than a bolt-on activity. This potential strength of UK approaches to competence-based learning, which approached competence from the starting point of workplace activities, was undermined somewhat by the focus on the assessment of specific work tasks rather than whole work processes. These limitations were widely discussed in the literature for more than a decade and were partially resolved in the move to learning outcomes. Some of the enduring challenges lie in the uneven quality of the environments for learning, resistance to regulatory regimes for workplace learning and the lack of emphasis on effective, contextualised pedagogic strategies for fostering learning in and through work. Although there are some very high-profile examples of excellence, there are too few of these and too many incidences of poor practices. The former are overreported, the latter often invisible. This is a long-standing problem. As long ago as 1997, Attwell observed that the ways forward lie in identification of new learning strategies and learning environments which can develop competence in a holistic manner and which provide for multidimensional qualification. These are newly emphasised in the search for fresh ways of thinking about the ways in which the different forms of knowledge that are embodied and enacted in competence are put to work. Promoting the interplay of 'formal' and 'informal' learning has become crucially important in the search for ways of developing holistic competence as part of knowledgeable practice, raising the further challenges of making NVQs enablers for the long-term development of expertise.

Goran and Svensson (2012), in an analysis of why many large-scale publicly funded European programmes of competence development prove unsustainable, have made a compelling case for projects for competence development to be embedded in the dynamics of real workplaces, with all their uncertainties, risks and creative potential. Active ownership of the learning processes is an essential ingredient if innovation is to be energised and development sustained. The importance of a broad strategic terrain at organisational level (Waite et al. 2014) has also been demonstrated. In the particular field of use of technology in learning, we know that effective learning is more likely to take place in enterprises

> where employees have greatest freedom in the organisation of their work, where employees have the greatest opportunities for proposing and implementing changes in the way work was organised, where the nature of technologies being used is changing fastest, where ICT is most involved in the work process, where employees have most responsibility for the outcomes of their work and where team work is most important (Attwell 1997).

This collective dimension in competence development, so often neglected, is central to organisational dynamics. The perspective of social ecology provides a way into understanding the complexities of factors that impact on learning and competence

development in the workplace, through the interplay of actors, structures, processes and environments. This interplay is not restricted to the workplace but involves the overlap of learning spaces and other contexts that extend way beyond the workplace. This social ecological lens does not provide instant solutions but does keep in view the factors that can confound even the most well-intentioned introduction of competence-based education and training programmes when they meet workplace realities. It also, most importantly, by highlighting the interdependencies – what or whom is depending upon what, in particular situations – shows the flows of influence and spaces for action that employees and their representative bodies, training practitioners and managers can use to realise more fully the benefits of competence development at work.

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Chapter 16
Competence Domains and Vocational-Professional Education in Germany

Susanne Weber and Frank Achtenhagen

16.1 Introduction

Discussing work-related competence issues in Germany has to take into account the different facets of the underlying 'collective skill formation regime' (cf. Busemeyer and Trampusch 2012). That means to realize the common strong interrelations and commitment of the so-called four tables – the Federal Government, the State Ministries, the Employers' Associations and the Trade Unions – but also their own logic, organization, arrangements and legal regulation.

Therefore, we, firstly, start with the presentation of basic context factors and cornerstones of German vocational education and training (VET) highlighting the inclusive and supportive character of VET in Germany, which safeguards poor achievers and drop outs but also challenges talents. Secondly, we trace some main historical roots of German VET. For the first phase (installation of VET), we describe the tension between general and vocational education as well as the installation of VET by institutions and law. The intention was to safeguard economy with solid qualified (low and medium/high skilled) workers and employees, but simultaneously to educate young people for enabling them to participate within active citizenship. For the second phase (the interpretation of curricula for VET), we focus on how the multiple stakeholders ('tables') in VET collectively engage for negotiating goals and required competence domains and levels of the various apprenticeship programmes. The actors are committed on solving complex authentic work problems balancing job-related and educational goals. Within the third phase (developing

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instructional means for VET), we highlight a huge research initiative on exploring and optimizing teaching and learning processes in vocational education and training. In phase four (developing means of assessment in VET), we discuss the necessity of improving formative and summative assessments in VET for getting insight into efficiency and effectivity of VET endeavours. Thirdly, we introduce a feasibility study – promoted by the German Ministry of Economy and Labour – for running a VET-PISA monitoring VET and, therefore, enabling international comparisons. Fourthly, the ASCOT Initiative (Assessment of Technology-Based Competence in Vocational Education and Training) aiming at development of instruments for modelling and measuring decisive VET competence in engineering, health and business is presented. An example on intrapreneurship competence for commercial education is given. The conclusion (fifthly/finally) wraps up central issues and gives a short outlook.

16.2 Cornerstones of German Vocational Education

Discussion of work-related competence issues for Germany must take into account its system and organization of vocational-professional education and training. Busemeyer and Trampusch (2012) characterize it as a 'collective skill formation regime', which emphasizes the common strong commitment of the so-called four tables: the Federal Government, the State Ministries, the Employers' Associations and the Trade Unions. The basis for this commitment and the common endeavour is regulated on the basis of the *Berufsbildungsgesetz* (Federal Law on VET 1969) by the so-called *Gemeinsames Ergebnisprotokoll* of 1972 (Common Protocol of Negotiations; KMK 1972). According to this common protocol, negotiation processes between these four stakeholders ('tables') of vocational-professional education are standardized, e.g. for identifying of and coping with upcoming (mainly economic or labour market driven) needs to reform, but also for installing a new *Beruf* covering a new and/or a changed bundle of job activities and setting up a corresponding apprenticeship of 2 or 3 years and for running bargaining procedures on goals, content, time, organization, etc. for the training companies and the vocational schools up to the political processes of acceptance. These processes need time – at least 1 year, but often also longer depending on the interest especially of employers and trade unions. In Germany, it is regulated by collective wage agreements that ensure apprentices after their apprenticeship have a guaranteed wage if they enter the economical or technical field to which their apprenticeship is related. This procedure is valid for about 330 so-called acknowledged apprenticeships in industry, crafts and commerce (the number changes slightly with regard to actual political decisions to open or to close an apprenticeship). Beside that there are about 100 training tracks in the social and health sectors. All decisions are published by the Federal Government together with the curricula for the vocational schools (1–2 days a week) and training regulations for the companies (4–3 days a week). Additionally, all companies running apprenticeship programmes have to be

officially acknowledged before they are allowed to provide vocational training within an acknowledged apprenticeship. This acknowledgement certificate ensures that the apprentices will have the necessary learning and development opportunities to reach the negotiated and fixed curricular goals for a particular apprenticeship. The quality of realized learning processes and outputs within the apprenticeship is monitored: the undertaken learning and working processes within the companies are visualized and documented by the weekly diary each apprentice has to write and present to the Chambers of Commerce or Chambers of Handicraft. The vocational schools balance the various practical workplace experiences (across the different industries, firm sizes, etc.) and link them to theoretical concepts, close gaps in general education (Maths, German, English), run critical reflections and support personal development (incl. work/adult identities). On both sides, highly educated trainers and vocational teachers are employed. The companies only get an acknowledgement to run an official VET when they additionally involve a trainer who has obtained an *Ausbildereignungsprüfung* (trainer certificate of the Chambers of Commerce). The examination as *Meister* in the fields of handicraft (with the career: *Lehrling* (apprentice), *Geselle* (journeyman) and *Meister* (master)) includes the right to train apprentices. Teachers of vocational schools possess a Master certificate of a university study programme, a 1-year internship in industry at different real workplaces and between 18 months and 2 years *Referendariat* (internship in vocational schools) with a final state examination. The education of vocational teachers corresponds to that for the secondary school level (*Gymnasium*/high school level). Their salary corresponds to that of all German civil servants on the highest level – that means University Master degree plus 2 years internship with a final state examination. This is also valid for judges at lower courts, attorneys and leading positions in the governmental institutions (*Ratslaufbahn* = counsellor career). The final apprenticeship examination (written, oral, practical) is externally driven by the Chambers of Commerce or Chambers of Handicraft (and *not* by the vocational schools or firms), benchmarked against the negotiated curriculum as the external evaluation criterion.

In Germany, the compulsory school attendance is 9 years (as education is not a Federal issue, there are some differences across the 16 states). Everyone who does not follow the general education track to the *Gymnasium* (3 years of high school) must undergo a 2–3 years apprenticeship to fulfil their school attendance. In cases of limited apprenticeships, there are public substitutional offers for youth (cf. contributions in Zeitschrift für Berufs- und Wirtschaftspädagogik (2014), 110, Vol. 2; Zeitschrift für Unterrichtswissenschaft (2014), Vol. 3).

The main idea is clear: The German vocational education system tries to pick up all youngsters independently of their prior knowledge or of the level at which they left general education. Through different learning locations (workplace, vocational schools, transitional learning opportunities, etc.), young people have the possibility to enhance their general education or close particular gaps and acquire basic occupational knowledge, skills and abilities. They get also counselling for their choice of *Beruf* as well as support for their applications on the labour market. By monitoring the apprenticeship process and evaluating the output against the prior negotiated

curriculum, the labour market gets a highly qualified workforce and can pay a corresponding fixed wage. The different acknowledged apprenticeships (covering a broad bundle of about 30,000 adult jobs) offer flexibility for individuals to change workplaces within or between firms and industries, while assuring wage levels. Thus, young people shift into financial independence and can take care of their own but also get integrated into an adult working community and supported in developing their work/adult identity which is relevant for social and political participation. In various vocational programmes, they can acquire preconditions for getting an additional opportunity to continue their general education and to start a tertiary career (the so-called 'permeability' of the system).

Such a complex 'collective skill formation regime' – of course – also has to deal with lots of tensions arising from different aims and to cope with high heterogeneity of students, stakeholder perspectives and contextual conditions, as well as with political decisions and market developments. For example, what knowledge, skills and attitudes should be taught (job specific, vocational subject specific, cross-occupational or generic)? To what extent should job-, company- or occupation-specific skills and/or abilities be taught? By which instructional means and at which locations should the curricular aims be reached (e.g. practical skills just by learning on the job and theoretical concepts in vocational schools)? Which instructional and learning theory is most efficient and effective for acquiring particular skills? Which kind of assessment should be run within the formative learning/working processes and within the summative final examination of the Chambers of Commerce (e.g. more by multiple-choice tests, open-ended questions, simulated negotiations with customers, but also the question by which evidence the prescribed curricular aims are counted as achieved is currently not sufficiently solved)?

16.3 Historical Considerations on Competence Development in Germany

The development of the German VET system in the last decades shall be ideally illustrated by four phases which are overlapping: The first phase was minted by the institutionalism of the system (until about 1972). A second phase is heavily influenced by needs of the workplaces – forced by the 'megatrends' which increased the complexity of technical and business processes. This led to a reformulation of the goals for the school curricula and training regulations under the headings *Lernfeldorientierung* and *Handlungsorientierung*. Working with the new goals urged in a third phase the development of instructional processes to reach and foster them. New complex teaching-learning arrangements/environments supported learning processes in school and at the workplace. To monitor the effects of these more complex goals and instructional processes made in the fourth phase, it is necessary to develop new ways of measurement which correspond to the complexity of goals

and instruction: the curriculum-instruction-assessment triad which consequently led also to plans to run a large-scale assessment for VET.

16.3.1 Phase 1: Installation of VET

The origins of this strong 'regime' were in the 1960s. Before, Germany had a multitude of measures and procedures which led to very disjointed outcomes – derived from the Middle Ages. The rapid technological changes as well as those of the internationalization of economic processes (later classified as 'megatrends': Buttler 1992; 2009) caused heavy political doubts whether the German economy with its backlog of VET would be able to react adequately to the increasing demand for a qualified workforce. Especially, the broad documentation by three volumes full of practical examples in the journal STERN (one example is Lutz et al. 1965) influenced the public opinion to come to new regulations for the fields of VET. This process was accompanied at the same time by educational approaches to overcome the segmentation of general academic education and vocational education which formed a nearly unnavigable border. The discussion was heavily influenced by ideas of Wilhelm von Humboldt (cf. Blankertz 1963) and Chomsky (1968, who based his considerations remarkably on Humboldt's philosophy of language), but also by the work of Habermas (1981). The argumentation led to the use of the concept of competence. Roth (1971) and later Reetz (1999) distinguished between self-competence, cognitive competence, functional competence and social competence (cf. Baethge et al. 2006). This broad concept with its competence domains and structure has until now dominated the German discussion – at least in the fields of VET but also in areas of work psychology (cf. Sonntag and Stegmaier 2007). These days they get further operationalized for assessment purposes.

It has to be pointed out that the four competence domains cannot be explicitly separated. For example, knowledge is not limited to the domain of cognitive competence, and different kinds of knowledge are applied in functional and social contexts as well; knowledge is used for performing theoretical occupation-related tasks utilizing tools, equipment and technical resources and in interactions with others; acquisitions and applications of knowledge are governed by motives and attitudes and by processes of reflection and meta-cognition.

As the authors of the feasibility study for a PISA-VET (Baethge et al. 2006) were aware of the multitude of proposals to define the competence concept with its facets on the national as well as international markets, they discuss in detail the different approaches (p. 13–58). Goal was to identify possible advantages and disadvantages of the proposals with regard to the dimensions of stringent modelling and precise measurement. The authors come to the decision – as result of their critical analyses – that the four competence domains by the anthropology-based educational-philosophical concept of Roth and Reetz in the shape of an empirical research concept (p. 45) might provide a plausible first basis to run an international large-scale assessment. The international curriculum conference within the preparation of

a feasibility study for mounting a VET-PISA also emphasized this holistic view and defined the aims of competence domains of vocational-professional education and training as:

1. The development of individual occupational adjustment from an individual user's point of view, taking self-regulation and autonomy into consideration
2. The safe guarding of human resources in a society
3. The warranty of social share and equal opportunities (Baethge et al. 2006, p. 11)

That this broad understanding of VET and the corresponding interpretation of vocational-professional competence were getting through in Germany over the last decades and that the VET regime could reduce the predominance of academic education were a result of different movements. Roth with his educational philosophy (1971) was the leading figure in the German Educational Council which defined in a new way the goals of the German Educational System and could, thereby, bring in his conviction into the official papers (especially: *Deutscher Bildungsrat* 1974). In parallel, there were efforts to formalize and legitimate the role of VET within the whole German Educational System. One was the trial to modernize the system by rearranging the relationship of academic and vocational education: that both together stood for German secondary education (after the 9th year of compulsory schooling). Blankertz and Lempert as responsible authors wrote a statement for the *Deutscher Ausschuss für das Erziehungs- und Bildungswesen* (German Committee for the Reform of the Educational System) that criticized the neglect of VET (*Gutachten über das berufliche Ausbildungs- und Schulwesen* 1966), which influenced the political discussion and led to the enhancement of VET. At the same time, a political decision was taken with regard to the foundation of a central research institute on VET. Blankertz and colleagues delivered an expertise which led to the installation of the *Bundesinstitut für Berufsbildung* (BiBB) in 1970 (Blankertz et al. 1966). In 1969, the first Federal Law on VET was edited. The *Gemeinsames Ergebnisprotokoll* was voted through this law. Founded in 1970, the BiBB (Federal Institute for Vocational Education and Training) aims at identifying future tasks of vocational education and training, promoting innovation in national and international vocational education and training and developing new, practice-oriented solutions for initial and continuing vocational education and training for the worksite. It is supervised on points of law concerning its administrative activities by the Federal Ministry of Education and Research. Its present statutory basis is the Vocational Training Act (*Berufsbildungsgesetz*) of 23 March 2005 (a renewal of the Law of 1969) which outlines the Institute's duties. These are currently, e.g. analysing structural developments in the training place market and in continuing education and training, observing and studying initial and continuing training practice in enterprises, testing new methods in the initial and continuing education and training field, identifying future skills requirements through early detection, developing and updating initial and continuing training occupations, supporting in-company vocational training practice with modern training materials and training media, developing concepts for qualifying company trainers and conducting international comparative research on vocational education and training (see the BiBB website: http://www.bibb.de/en/1420.htm).

16.3.2 Phase 2: Interpretation of VET Competence Domains (Curriculum)

In the following years, the competence interpretation process was still valid for Germany. Various curriculum projects were established to develop curriculum theories (Robinsohn 1967; Frey et al. 1975; Hameyer et al. 1983), to investigate empirically VET teaching and learning processes as well as teacher-learner interactions, etc. (cf. Achtenhagen and Tramm 1983). The results of these endeavours show that the content was highly abstract, mainly cognitive related on a relatively low level and assessed by batteries of multiple-choice tasks testing abstract knowledge. The discussion on VET competence domains and levels got a stimulus by the introduction of the concept of *Lernfeldorientierung* (orientation on complex vocational-professional activities in larger learning and training areas) which should help to develop action-oriented competence (*Handlungskompetenz*) (KMK 1996). It emphasizes the fact that VET and vocational-professional competence shall focus on the complexity and authenticity of tasks to be fulfilled at the workplaces. Coping with isolated functions of a motor should not stay in the centre of teaching and learning within an automobile apprenticeship but in the contrary: the functioning of a motor as a whole should be the focus. This principle led to reformulations of the VET school curricula as well as of the training regulations. The German VET skill regime – demonstrated by the *Gemeinsames Ergebnisprotokoll* – established this renewal by an agreement of all four 'tables'. These new ideas were accompanied by many research trails ('Modellversuche') which were in sum not very effective, especially for their lack of psychometric methods.

16.3.3 Phase 3: Instructional Means for Teaching VET Competence (Instruction)

Subsequently, German research in the fields of vocational-professional education and training followed this comprehensive understanding of competence and tried to work it out in more detail. Under the scope of *Lernfeldorientierung* and *Handlungskompetenz*, different means were developed to enrich the teaching-training and learning-working situations within the different apprenticeships. The aim was to model complex teaching-learning environments by which comprehensive vocational-professional actions could be taught and trained, but also evaluated (cf. Achtenhagen and John 1992; Achtenhagen 2002). This task urged new ways to model such complex situations in an authentic way (Achtenhagen 2001; Achtenhagen and Weber 2003; Janesick 2006). Weber (2013), here, introduced the necessity also to take into account different system levels (micro, meso, macro) and locations of workplace learning (VET schools, firms or other institutions). Another point has been to operationalize the concept of 'knowledge' with regard to the needs of the workplace by introducing in addition to declarative and functional knowledge the

dimension of strategic knowledge (cf. Achtenhagen 2004). This dimension is important for successful working at the workplaces as it deals with weighing detailed information (as declarative and functional knowledge) concerning intended main effects and given possible unintended side effects to come to adequate and effective decisions. The approaches stand for trials against rote learning. For example, see the concept mapping approach on network-like thinking in business education (Weber 1994) or the intervention study for enhancing intercultural competence as a necessary requirement in the internationalization processes on the market (Weber 2005).

These different approaches were supported by a focus programme of the German Research Council: *Lehr-Lern-Prozesse in der kaufmännischen Erstausbildung* (teaching-learning processes in initial commercial education and training) (1994–2000) (Beck 2002; Beck and Heid 1996; Beck and Krumm 2001) – which referred to the recommendations of a critical overview report on the state of the art of German VET research (DFG 1990). Here in close cooperation of Human Resource Education (*Wirtschaftspädagogik*) with Psychology, a well-diversified bundle of research projects was run which helped to further operationalize the competence concept as well as to evaluate different instructional measures urged by these new curricular goals.

16.3.4 Phase 4: Developing Means for Evaluating VET Competence (Assessment)

For developing the efficiency and effectiveness of VET training courses or programmes, it was necessary to put emphasis on evaluation activities (cf. Weber 1994) as assessment work was underdeveloped in German VET research – compared to psychological approaches. Evaluation was done more with the focus on individual aims of specific courses/programmes and single constructs like, e.g. knowledge, network-like thinking or motivation and less under a systematic view on the basis of a particular 'competence' concept or under an overarching structural comparative view.

The endeavour to develop VET and VET assessments more systematically was supported by the results of the PISA studies in the area of compulsory education which brought for the German field of VET research at least three main impetus: (a) they showed for the area of compulsory education a relatively bad achievement; (b) the format of the test items was not suitable for measuring VET competence as they did not allow to mirror workplace actions and activities; and (c) they showed the advantage of new statistical approaches, especially item response theory. (Although these methods have been proposed for a long time, e.g. by Achtenhagen and Tramm (1983), they had not been executed in the field of VET until the PISA wave.) A German Federal Initiative developed – as an answer to the bad PISA results – national standards for compulsory academic education (Klieme et al. 2003), but neglected the vocational-professional field.

These topics showed the necessity to develop further the competence concept for VET together with a reform of curricula, training regulations, instruction and assessment tools. As such profound reform needs a lot of conviction and time, a research group proposed to treat these necessities by generating a feasibility study on a VET-PISA as a frame to also bring in exemplarily an articulated competence concept for VET (Baethge et al. 2006). This strategy should serve as a motor to rethink and revise the overarching competence domain in VET, at least in Germany. This proposal was accepted and promoted by the German Federal Ministry of Economy and Labour.

The plan is to run a PISA study for professional fields. The needs were also supported by analyses of international concepts of VET within the European COST-Action A11 (Achtenhagen et al. 1995; Achtenhagen and Thang 2002; Achtenhagen and Weber 2008); the survey of international vocational education and training within the Fourth Handbook of Research on Teaching of the American Educational Research Association (AERA) (Achtenhagen and Grubb 2001); and the OECD-driven DESECO approach (Rychen and Salganik 2001) defining especially cross-curricular competence and key competence as central goals by domains of 'acting autonomously', 'using tools interactively' and 'joining and functioning in socially heterogeneous groups' – a study with explicit connections to Roth's concept of competence and Weinert's (2001) widely accepted competence definition, as well as from comparative approaches to regulate the European qualification systems by the European Qualification Framework (EQF) and the European credit transfer system for vocational education and training (ECVET) (cf. Cedefop 2014). Central goals, here, are to increase transparency of VET in Europe and facilitate comparability of vocational competence.

One major problem of most of these proposals and schemata for comparison has been the fact that there was a lack of precise measurement – especially taking into account the competence concept. A study of Fulst-Bleil and Ebner (2005), for example, demonstrates by comparison of the English-Welsh level of 'GNVQ Advance Business' and the German level of *Industriekaufmann* (industrial clerk) that the German apprenticeship should have been classified higher or at least equal to the English-Welsh endeavour, although according to the English-Welsh approach its course was ranked higher. Recent examples demonstrate that neither EQF nor ECVET provides a basis to promote and guard political or practical decisions. In Germany, this means, for example, the inability to define and coordinate consensually and adequately the levels of the gymnasium-leaving certificate (*Abitur*) and of apprenticeships.

16.4 The VET-PISA Concept

Mainly two facts led to the development of a VET-PISA concept:

1. Although the PISA action caused in Germany a lot of attention and political reaction for the general academic sector, it was clear that the item patterns used did not work in the vocational and occupational fields. They were/are too simple to model and measure workplace affordances.
2. The experiences won with the complex reformulation of goals, instruction and assessment strengthened the suggestion to develop plans for a PISA study which would be adequate for VET. Consequently, a concept was developed as feasibility study (Baethge et al. 2006), first cross-national studies (Baethge and Arends 2009) and first assessments (Achtenhagen and Winther 2009; Nickolaus et al. 2009) were run. As a consequence the German Federal Ministry of Education and Research started the ASCOT Initiative to develop further modelling and measuring competence in central VET domains.

16.5 Feasibility Study

As a consequence of these manifold facts and observations, Baethge et al. (2006) developed the concept of a large-scale assessment of VET following the TIMSS and PISA approaches for the compulsory school system. The clear purpose was to operationalize, to model and to measure the competencies necessary to fulfil tasks in the workplace and, thus, to provide robust results to inform the setting of levels for VET programmes (cf. also Weber 2013) – which also could help define valid and reliable levels of the EQF and ECVET. It was central to bring together individual capabilities and workplace skill requirements under the heading of competence – thereby avoiding aspects of a reduced adaptation of VET to the needs of workplaces. The group (1) refers to the international discussion (cf. Malloch et al. 2011; Mulder 2011, 2005; Nijhof and Streumer 1998; Rauner and Maclean 2008; Rychen and Salganik 2003; and also more empirical oriented: Spencer and Spencer 1993; Peterson et al. 1999, 2001; Oser et al. 2009; Winterton 2009; Scott and Reynolds 2010; Griffin et al. 2012). A second step (2) is to keep and to develop further a comprehensive understanding of VET and correspondingly of competence as it is founded by the educational-philosophical tradition (cf. Roth 1971; Reetz 1999; Habermas 1981; see also summarizing Seeber and Nickolaus 2010; Seeber et al. 2010; Zlatkin-Troitschanskaia and Seidel 2011). This includes (3) the reflection of goals and content of VET for formulating the items as workplace-related authentic tasks with their inherent complexity, the consideration of how complex the instructional methods are at the workplace and in the vocational schools – or should be – and the formulation of the items themselves that they show a complexity which corresponds to the goals, experiences and authentic workplace tasks and enables to show evidence for the intended achieved ability. The concept of the curriculum-instruction-assessment triad (Pellegrino 2010; Achtenhagen 2012) covers this approach of comparable complexity of goals, learning/working situations and items for assessment and helps, therefore, to overcome the neglect of the importance of

test procedures in the field of VET and to measure competence in a sense-making, psychometrically supported way.

Comparable to the triad approach, considerations on the alignment of goals, instruction and evaluation are given. As a prominent example for university teaching and learning, see Briggs and Tang (2011). They give excellent hints for practitioners, but do not deliver an overarching theory for necessary curricular and instructional decisions or for the choice (and complexity) of assessment. This corresponds to the fact that they avoid a philosophy-driven reasoning on their approach – points that are included in the curriculum-instruction-assessment triad.

From a policy perspective, such complex assessment procedures might improve an evidence-based monitoring and steering of VET particularly with regard to (a) the interrelationship among individual/biographical characteristics, educational programmes and competence development; (b) the link between the outcomes of comparative measurements and institutional capacity of VET systems (revealing strengths and weaknesses of different VET organizations in different countries); (c) the interrelationship between certificates of final examinations and the competence assessed; and (d) the classification of different examinations in VET in international systems of classification (e.g. ISCED; EQF) to improve certification methods at the European level.

16.6 Identifying Cross-National Overlaps of VET Competence

To measure and compare performance of national VET systems – including Germany – regarding the goals of VET, the necessary competence levels and their structural relationship with institutional factors and input criteria, at least three methodological problems had to be solved:

(a) With regard to the differences in job-classification schemata in the participating countries, how can occupational fields and work activities be identified and internationally related to each other?
(b) How can vocational competence be measured and compared?
(c) How can the relevant micro- and macrostructural conditions of the VET systems in different countries be analysed and compared?

These questions were formulated by experts from 18 countries (including the USA, Australia and also Cedefop).

The basic ideas were tested through feasibility studies in eight European countries with N = 349 experts in the fields of technology, health and commerce (Baethge and Arends 2009). In the field of business and commerce, run by Breuer et al. (2009), 70 experts from six countries undertook the task by referring to ISCED 3B, ILO 08-33 and O*NET (job zone 3 or 4; SVP 6.0 to < 8.0). All six countries agreed that nine occupational tasks were representative for the fields of business and

commerce. The tasks were judged by the countries on their relevance. The judgments of the relevance of occupational tasks show for the three highest ranked tasks the following structure (cf. Breuer et al. 2009, p. 74):

- Prepare invoices, reports, memos, letters, financial statements and other documents.
- Respond to customers'/suppliers' inquiries about order status, changes and cancellations.
- Review files, records and other documents to obtain information to respond to requests.

16.7 Creating First Assessments

To measure the competence to fulfil such occupational tasks, it was necessary by a next step to develop test items which could mirror the complexity and difficulty of workplace tasks. Within a following project, Achtenhagen and Winther (2009; cf. also Winther 2010; Achtenhagen and Winther 2014) used the results of the feasibility study and the concept of complex teaching-learning environments for the fields of business and commerce to model a computer-based virtual enterprise and its workplaces in accordance with a real firm and constructed for that virtual enterprise a comprehensive data packet with all means and data necessary to follow realistic business processes (parallelly, there was a second study in the fields of car mechatronics: Nickolaus et al. 2009). Data included, for example, balances, cost accounting and prices for different products. There were also descriptions of workplaces of different departments. Because business processes are related mainly to the handling of information and data, it is important, for maintaining authenticity, to transform them in such a way that they are realistic. The tasks to handle the information and data are, therefore, the same as in real firms. This is the basis for testing workplace learning and corresponding competence: using workplaces of a virtual enterprise objectively, reliably and validly. Experts of the real firms also checked all the tasks to be fulfilled in the virtual enterprise with regard to their typicality. Agreement was unanimous.

The tasks were converted into a web-based format. The technology-based assessment focuses on the meaning, range and level of specific work-related skills and abilities in the occupational fields of business and commerce. To provide authenticity, content validity and practical adaptability during the test, the assessment is grounded on a real company as a benchmark. The modelling requirements are strict. First, a transparent method of production together with a short part list of production items is necessary to clarify the company's objects also for apprentices/employees trained in other firms. Second, well-known products are incorporated to guarantee identifying marks during the test. Achtenhagen and Winther (2009) installed a virtual company called ALUSIM Ltd. which fabricates aluminium packages to act as the context for the assessment. The company's products are beverage

cans (Coca-Cola), cosmetics (Nivea) and food-grade packaging. Authentic parameters of modelling were used, including company history and reporting (e.g. balance sheet, profit and loss statements, cash-flow analyses). Third, authentic large volume production and its corresponding costs were included, together with real-world customers and suppliers. An important criterion for authenticity and, therefore, for the measurement of workplace-related competence was to embed the tasks sequentially in processes to avoid an unrealistic static handling of isolated tasks.

The virtual enterprise was constructed with workplace tasks of three departments according to those identified by the international feasibility study: sales department (three sequences of tasks), purchasing department (four sequences) and production planning department (two sequences). This also included the development of different technology-based tools such as story boards of authentic business processes; applications of integrated ERP systems, including customer and supplier lists, in-depth analyses of the designed company; and so on.

All these products and modelling steps are necessary to stimulate performance in authentic vocational situations and work processes as key elements of competence measurement. In other words, a simulation of real-world conditions ensures measurement of authentic abilities without bringing those being tested into such real-world situations. Therefore, the business simulation contains complete business processes. This focus guarantees interpretability of test results. The simulation ensures a content-related and cognition-based characterization of the test environment and provides a valid description of personal abilities and item difficulties with regard to concrete test challenges, thereby permitting a psychometric modelling approach.

All domain-specific challenges are video based and refer to a complete sequence of tasks (e.g. work processes). The test subjects navigate through the tasks using an interactive desktop which encompasses all documents, ERP systems, filings and helping tools to test the ability to cope efficiently and effectively with the tasks and to solve them as a basis for the measurement of competence.

Starting the video opens the domain-specific challenge. The test subjects watch a dialogue between a trainee and an employee, which contains useful information and a reference to solving the process. However, different work processes structure each challenge. The sales challenge, for example, starts with two steps. First, the test subjects must enter customer data into the ERP system. Therefore, they must review all relevant customer information, the ERP requirements and the production process. In a second step, another test situation, the trainee receives information from the production department that the sale cannot be closed on usual terms. The trainee must manage that situation by contacting the customer. The outlined work process demands a deep understanding of sale records, economic conditions, customer buying patterns and sensitivities. The test subject must anticipate the entire production process to find the new delivery date, make the right decision and inform the customer correctly and (to prompt a long-term relationship with the customer) also politely, which is part of the corresponding test item. Thus, both work processes refer to different complexity levels.

Achtenhagen and Winther (2009) assigned all different actions to be fulfilled within this virtual workplace to test items. They coded the quality of the corresponding actions per item (as 0/1 or graduated). The test consists of 34 items related to business actions and 26 items related to the comprehension of business processes. They run the test with 264 test subjects (third year apprenticeship industrial clerks) in 15 classrooms in seven commercial schools in three German States. The subjects were between 20 and 23 years old.

Achtenhagen and Winther (2009) analysed their data by applying a multidimensional random coefficient-multinomial logit model out of the family of item response theory (IRT) for competence measurement (Adams et al. 1997) using the software ConQuest (Wu et al. 2007). The results show that the model fits the empirical data. All values for validity and reliability of the test results are very good.

By this procedure, they scaled up the items according to their difficulty and the subjects' abilities simultaneously on the same logit scale. This is a great advantage as in classical test theory, the analyses are just run by summing up the subjects' total test scores. That means individuals with the same total test score are assigned to the same competence level irrespective of whether one has solved the more easy tasks and the other the more difficult ones.

Furthermore, Achtenhagen and Winther (2009) could identify by their analyses two competence dimensions: 'action-based competence' and 'understanding-based competence'. Test subjects showed a higher competence in solving the 'action-based' test tasks than solving the more cognitively driven 'understanding-based' tasks at the end of their 3 years apprenticeship.

16.8 The ASCOT Initiative as a Nation-Wide Pilot

Although VET, in research and practice, was highly inspired by these first VET-PISA endeavours, the initiatives were hindered for some years in Germany for political reasons: one of the four 'tables' feared a loss of influence. But the needs for reform were great, so a Federal Research Initiative was started on the basis of the given research results: ASCOT (Technology-Based Competence Development in Vocational Education and Training; http://ascot-vet.net/) for the areas business and commerce, technology and health and care. For the business and commerce sector, four projects were run: two following and enlarging the ALUSIM approach for industrial clerks (Winther, University of Paderborn) and apprentices for transport and logistics (Seeber, University of Göttingen), one for problem-solving in controlling (Seifried, University of Mannheim; Wuttke, University of Frankfurt; Sembill and Rausch, University of Bamberg; Wolf, University of Bremen) (together with a focus on emotion and motivation; Sembill et al. 2013) and one for intrapreneurship (Weber et al. 2014a, b).

With regard to the increasing interest on the European Labour Market in entrepreneurial and intrapreneurial mindsets for mastering the tremendous competition in various markets (Parent-Thirion et al. 2008), this fourth project deals with the

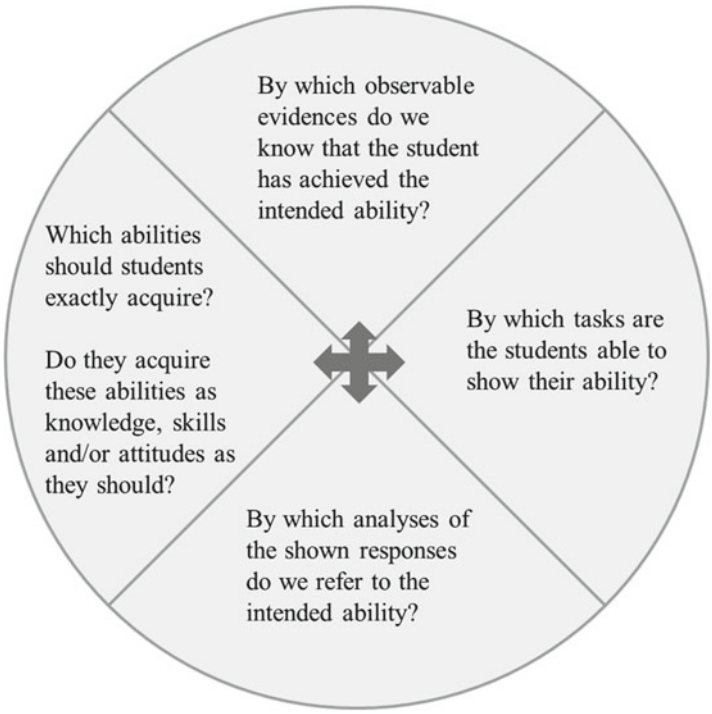

Fig. 16.1 Central categories of an evidence-centred assessment design (Source: Own graph according to Pellegrino et al. 2014)

modelling and measurement of intrapreneurship competence as a central goal in commercial curricula (e.g. industrial clerks) (Weber et al. 2014a, b).

The modelling and measurement processes of the research group around Weber are based on the 'Evidence-Centred Design [ECD]' approach of the Educational Testing Service [ETS] in Princeton (Mislevy and Haertel 2006; Mislevy and Riconscente 2006; Pellegrino et al. 2014), considering the four building blocks of Wilson (2005) as well as those of Shavelson (2012) (Fig. 16.1):

According to these suggestions, Weber and colleagues (see Weber et al. 2014a, b)

- *Run an extensive domain analysis*
  For gathering substantive information on the domain: asking what is the epistemology of the knowledge under investigation and corresponding implications for learning, teaching and assessment
- *Conduct a domain modelling*
  To express the assessment goal in narrative form based on the domain analyses
- *Build a conceptual assessment framework*
  To express the assessment goal in structures and specifications for tasks and tests, evaluation procedures and measurement models

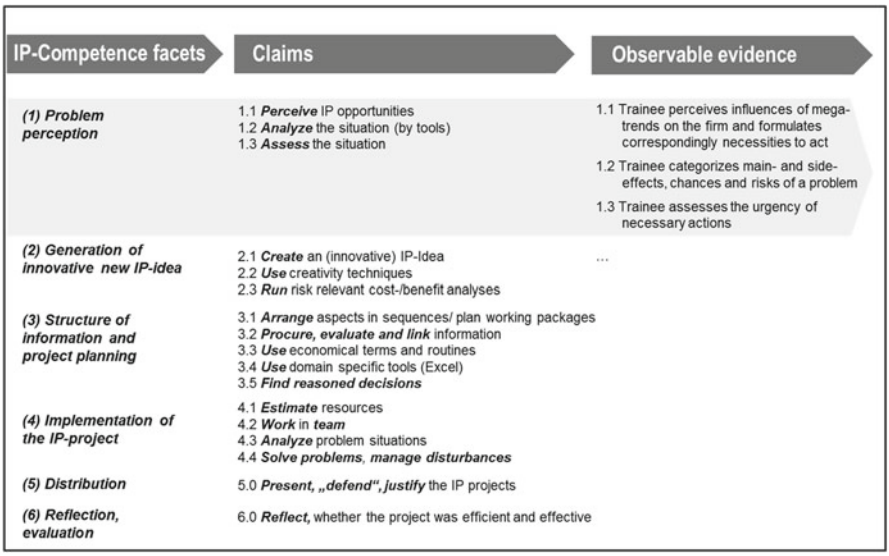

Fig. 16.2 Competence facets, claims and evidences (Source: Own graph according to Pellegrino et al. 2014; Weber et al. 2014a)

- *Imply the assessment*
  To implement the assessment, including presentation-ready tasks and calibrated measurement models
- *Deliver the assessment*
  To coordinate interactions of students and tasks, scoring and reporting

According to the results of their domain analyses, the research group defined 'intrapreneurship' in accordance with Perlman et al. (1988) as a process. Within such an intrapreneurship process, a person meets his or her needs for autonomy, invention, management and completion of projects within a complex bureaucracy. Furthermore, intrapreneurship is perceived as a process by which new ventures, products and projects are developed and implemented in organizations.

The group of Weber conceptualized intrapreneurship behaviour on the basis of their extensive domain analyses as 'innovative behaviour' of an individual (Rupprecht et al. 2011). Thus, an individual is seen as a competent 'intrapreneur' when he/she is able to activate and use the following six intrapreneurial competence (IP) facets while solving complex, authentic intrapreneurial tasks (Fig. 16.2). These competence facets were further operationalized with regard to claims which visualize the facets more in detail. It is also shown how evidences for these claims of a competence facet can be empirically observed.

As intrapreneurship is part of the official curriculum in schools and at workplaces, Weber and colleagues tried to get insight into the current intrapreneurial behaviour of trainees at the workplace by their domain analyses. The group was able to collect a randomly selected sample of 'final exam reports' of industrial clerks at the end of

their 3 years of apprenticeship for the year 2011/2012 in Upper Bavaria (N = 205). The corresponding Chamber of Industry and Commerce facilitated access. Each report covers about 6 pages and represents an intrapreneurship project run by an individual apprentice at the worksite within his/her training company. The papers varied tremendously with regard to their project themes (e.g. supervising a communication campaign via the social network 'Facebook', invoice management, implementation of an integrated health management process, new regulations for the export into a West-African country). Nevertheless, the documented intrapreneurship activities could be categorized according to the competence model (Fig. 16.2). The apprentices formulated sentences which are coded as units.

A unit like '… as this division is organized by cycle times, for this period 'jumpers' are deployed' was categorized under the IP facet '(4) implementing (IP) projects', and a unit like '…with 5.000 participants especially the table-lottery for the 'Oktoberfest' was very popular …' was aligned to the IP facet '(6) reflection evaluation'. The raters were trained and 45 reports were coded commonly by two raters. The interrater reliability according to Cohen's Kappa = 0.81 could be judged as very high (Fleiss and Cohen 1973).

The data won by the content analysis were additionally coded dichotomously for each individual and each category to be used within an IRT analysis (1 = competence facet/claim used; 0 = competence facet/claim not used). For the calculation, the one-dimensional Rasch model (1PL Model) (Rost 2004) was applied using the software ConQuest (Wu et al. 2007). The model describes the probability distribution of dichotomous answers as dependent variables in relation to the independent variables (ability of the testee and item difficulty). The answers determine the probability by which a testee with a specific ability solves an item with a particular difficulty correctly – the probability by which an apprentice with a specific intrapreneurship competence uses the particular intrapreneurship facet (Wright and Stone 1979, S. 15–17). The relationship of apprentices' skills and item difficulty/used claim is visualized by the Wright Map (see Fig. 16.3).

The individual apprentices are represented by the crosses on the left-hand side of the logit scale (and can be identified individually), and the items/claims (according to Fig. 16.2) are represented by the numbers on the right-hand side of the scale. By that, it is possible to identify the intrapreneurship competence of the individual testee and also the difficulty of the single item/claim. The model works as follows: each apprentice applied the claim(s) which is on the same horizontal line with a probability of 50 %, the claims below this line with a higher probability (as they are easier) and the claims above this line with a lower probability (as they are more difficult). For example, no. 2.1 represents the claim 'create an (innovative) IP-idea' which seems to be rather difficult. No. 3.1 represents the claim 'arrange aspects in sequences/plan working packages' which has a medium difficulty. No. 4.1 represents the claim 'estimate resources' which seems to be very easy.

The fit statistics show very acceptable values. The WLE reliability is 0.7, and the discrimination index for all items is $0.18 < d < 0.70$ (Weber et al. 2015).

The advantage of this procedure is that one gets values to judge the competence of the test subjects with regard to the difficulty of the tasks. Thus, this procedure and

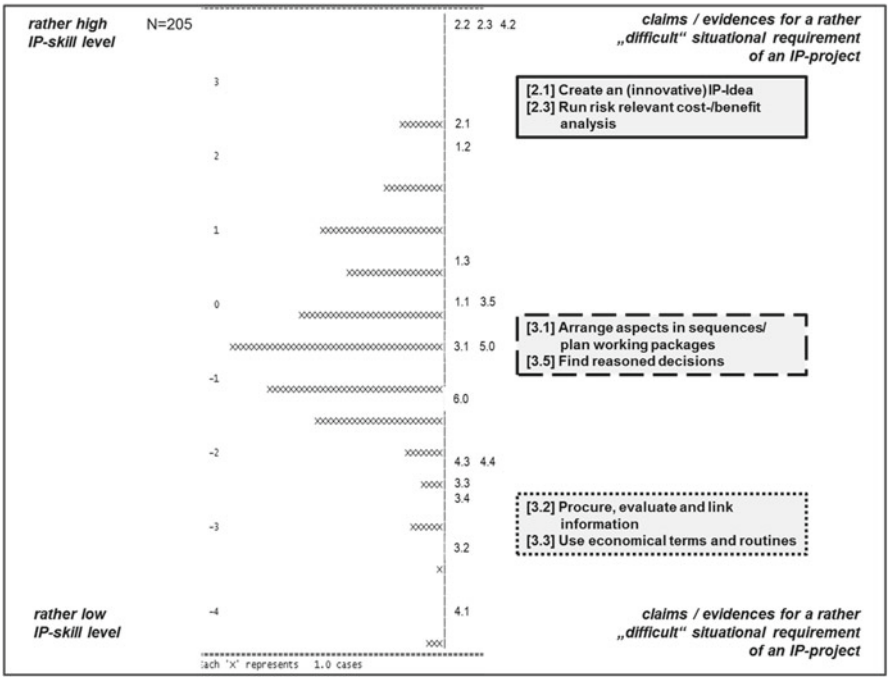

Fig. 16.3 Wright Map – use of facets of intrapreneurship behaviour of industrial clerks (Source: Own graph according to Weber et al. 2015)

its results open new possibilities to enrich the quality of vocational-professional teaching/training and learning/working processes: as it can be seen which content must be taught again or must be presented in another way. This opens new paths to a more efficient and effective workplace learning. The results can also be used for the development of a PISA-VET and give hints for a renewal of a commercial apprenticeship for industrial clerks.

Whereas the IRT scales up competence and difficulties of work tasks for more overarching summative assessment and monitoring (incl. comparative studies), we continue the work on measuring competence for a formative assessment and cognitive diagnostic measurement (CDM) (Helm et al. 2015). The idea is to work out an individual's personal competence profile to identify individual strengths and weaknesses for an individual feedback and enhance vocational-professional learning and development. For this step, explicit cognitive processes used while solving the tasks have been analysed (mainly by running think alouds, expert interviews, etc.) (Bley 2015) and other psychometrical models have to be applied.

16.9 Conclusions

This chapter presents examples for competence domains within vocational-professional education in Germany. Departing from the cornerstones of the 'collective skill formation regime' in Germany, some historical highlights are given: the implementation of VET and the development of VET-oriented skills. One major problem of VET in Germany, but also in all industrialized countries, is to prepare youth for the increased complexity of tasks at the workplaces. The discussion above should have made clear that it is not enough to 'just formulate' desired competence domains. It is necessary (1) to link the competence construct to a theoretical frame (as here, e.g. to the holistic anthropologically based competence concept of Roth (1971) and Reetz (1999) as well as the integrative model of Weinert (2001) and Winterton (2009) and other domain-specific theories and concepts), but also to relate them to the current labour market and corresponding needs (domain analyses, O*NET) – that means structurally (which kind of knowledge, skills and attitudes is relevant) and with regard to the content (accounting, intrapreneurship etc.); (2) to operationalize them further as concrete teachable and learnable claims for an efficient and effective instruction on different sites (school, workplace); and (3) to run formative and summative assessments that are able to secure by evidences whether an individual has acquired the competence or not. For such an assessment, a close alignment between curriculum-instruction-assessment triad is indispensable and prior to a sound model-based psychometric measurement (Embretson 2010).

With regard to a VET-PISA, this alignment within the triad as well as further national and organizational context factors has to be negotiated. But the initiatives and exemplary projects presented here might open new views on a challenging pathway.

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Chapter 17
The Competence Development Agenda in France

Françoise Le Deist

17.1 Introduction

Debates about competence in France were initiated in the early 1980s when it was widely recognised that the school-based and state-regulated vocational education and training system was insufficiently responsive to the changing needs of the labour market. In 1985 the state introduced a system of assessing skills and knowledge gained through work experience (*Validation des acquis professionnels*) which recognised competence without calling it such. The human resource management profession developed *Gestion Prévisionnelle des Emplois et des Compétences* (GPEC) for forecasting future personnel and skill needs, especially in a context of restructuring. The national employment agency (*Agence nationale pour l'emploi*) published a catalogue of occupations (*Répertoire Opérationnel des Métiers et des Emplois*) designed to facilitate redeployment of individuals facing redundancy, and in 1993 the occupations listed were defined in terms of their requisite competencies. In 1991 the state introduced a right for individuals to have a skills audit (*bilan de compétences*) undertaken by independent organisations to provide a basis for personal development in their occupation. During the 1990s some large organisations explicitly used the logic of competence as a way of reducing labour market rigidities associated with the logic of qualifications. Towards the end of the 1990s, the employers' association *Mouvement des Entreprises de France* (MEDEF) began promoting competence as a way of increasing labour mobility through adaptability and employability, officially launching the initiative *Objectif compétences* in 2002. A comprehensive national agreement (*Accord National Interprofessionnel*) between the employers and trade unions signed on 20 September 2003 gave a further impetus to the competence movement. Organisations are required to develop a company

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training plan (*plan de formation*) in line with sector priorities for training and to undertake a developmental appraisal interview (*entretien professionnel*) with each employee at least every 2 years to identify training and development needs, which should also address specific competencies.

The prevailing conceptual approach to competence in France is usually described as comprising *savoirs* (*competence theories*, i.e. knowledge), *savoir-faire* (*compétences pratique competence in practices*, i.e. functional competencies) and *savoir-être* (*compétences sociales et comportementales*, i.e. social or behavioural competencies). This conceptual approach is both comprehensive and 'elegant' (in a mathematical sense) in its simplicity: since each of these dimensions aligns quite closely with other leading competence models, it can be considered useful in reconciling the alternative models. The *savoir* dimension has clear parallels with the underpinning knowledge described in the German competence model (*Fachkompetenz* and its underlying *Sachkompetenz*). The *savoir-faire* dimension equates closely with the British occupational competence model that emphasises functional job skills. The *savoir-être* dimension approximates to the American model with its emphasis on psychological traits and social attitudes and behaviours.

Reform of the French qualifications framework began in 2002 when the competence movement was already substantially embedded in larger organisations. The National Commission for Vocational Certification (CNCP, *Commission Nationale de la Certification Professionnelle*) was established as a joint national body with equal numbers of employer and union representatives to implement the changes and develop a national catalogue of vocational qualifications (RNCP, *Répertoire National des Certifications Professionnelles*). Their work paved the way for the landmark national agreement on vocational training (*Accord National Interprofessionnel*) on 20 September 2003. Competence operates as a pivot between the individual and the organisation: organisations use GPEC to forecast future employment and skills needs, formulating a training plan that takes into account sector priorities. Individuals have access to the *bilan de compétence* to aid career development and to *Validation des Acquis de l'Experience* (VAE) for validation of experience to attain qualifications. The competence requirements for (evolving) posts are compared with the acquired competencies of individuals in the development interview which identifies training needs that are incorporated in the training plan. Further reform of the French qualifications framework is still underway to align it with the European Qualifications Framework.

It is difficult to overestimate the importance of qualifications (official diplomas) in France. Access to senior managerial positions is restricted to graduates of the elite business schools (*Grandes Ecoles*), and to obtain a post in virtually any occupation (*métier*), specific state-recognised qualifications are required and specified in the official state-maintained directory of occupations (*Répertoire Opérationnel des Métiers et des Emplois*, or ROME). To work at craft or technician level, individuals must have the appropriate qualification, which is a major factor

determining a person's position on pay scales. This focus on qualifications in the context of a state-regulated, education-led vocational training system and a highly regulated labour market has created rigidities that act as impediments to the adaptability and flexibility demanded in this era of global competition. Employers argued the need to align training more closely with labour market needs and the social partners engaged with state agencies in the reform and rationalisation of vocational qualifications. The concept of *compétence* played a central role in these developments, particularly since the adoption of the European Qualifications Framework, but initially doubts were raised as to the extent to which the adoption of competence-based approaches represented more than a semantic change (Livian and Courpasson 1991), and it was a struggle for the logic of competence to replace the logic of qualifications (Cavestro and Sonzongni 1999).

The primary objective of this chapter is to explore the competence model that developed in France, to assess the extent to which competence-based approaches have been adopted and to compare theory, policy and practice in relation to competence. The following section traces the emergence of a competence movement in France and the initiatives of the state and social partner organisations. The chapter then explores conceptual approaches to competence in France and compares the French approach with other dominant European competence models. The practice of competence management is explored in terms of the extent of adoption and the initiatives of leading-edge organisations, especially in the steel and automotive sectors. The role of competence is then considered in modernising vocational education and training and in rationalising qualifications. A concluding section offers a summary and assesses the overall significance of competence in vocational and professional education in France.

17.2 The Origins of the Competence Movement

In the early 1980s, it was already apparent that the system of vocational education in France was inadequate for the task of meeting the new needs of the labour market and that organisations, rather than vocational schools, would have to develop competence-based training (Cannac and CEGOS 1985). Cedefop (2002) and Troger (2004) both stated that the strongly school-based academic model of VET (under the social and economic domination of the general education system) was reformed at this time in view of the changing organisation of work. In 1985, individuals with work experience were given the opportunity to enrol in education and training programmes at postsecondary level based on their work experience and personal attainments elaborated in individual portfolios that would be examined by an assessment panel. This process of validation of job experience (*Validation des acquis professionnels*) involved assessing and recognising knowledge and skills gained experientially, which raised issues concerning the relationship between such competence and qualifications (Paradeise 1987) in France (Cedefop 2002; Troger 2004).

The idea of managing competence in organisations first appeared in the 1980s as organisations faced a continuous challenge of restructuring. The national employment agency (*Agence nationale pour l'emploi*) launched the catalogue of occupations (ROME, see above) at this time, which was designed to facilitate redeployment of individuals facing redundancy. Competence management instruments were developed by HRM practitioners during the 1990s (Gilbert 2003). From the second half of the 1990s, more attention was paid to the theoretical conceptualization of competence, and at the same time, more critical analyses of the use of competence in organisations appeared, and in 1993 the *ROME* catalogue was modified and occupations were defined in terms of their requisite competencies. There was a flurry of literature on competence management at this time (Le Boterf 1994; Levy-Leboyer 1996; Merle 1996; Minet et al. 1994; Mitrani 1992; Ropé and Tanguy 1994).

As a more structured approach to competence developed in leading-edge organisations, notably Sollac in Dunkerque, Propharm and Crédit Mutuel de Bretagne, and later at Renault (Haddadj and Besson 2000b), new approaches towards managing and forecasting personnel and skill needs, known as *Gestion Prévisionnelle des Emplois et des Compétences* (GPEC), emerged. The GPEC approach explicitly recognised human resources as assets producing competitive advantage and proved particularly useful for managing organisational transformation (Raoult 1991). The GPEC approach was widely seen as a key mechanism for replacing the logic of qualification with the logic of competence but also as an instrument for promoting individual evaluation in place of collectivist structures of remuneration and, by implication, undermining job security (Arnaud and Lauriol 2002; Cavestro and Sonzongni 1999; Durand 2000a; Lacroix 1998; Marbach 1999; Oiry and d'Iribarne 2001; Pochet 1999). Competence is more than simply a substitute for qualifications, which are in essence a testimony/certificate of competence (Tanguy 1998; Zimmerman 2000), but in the French context, the adoption of competence-based approaches was seen as a major route to reducing the labour market rigidities of a qualifications-based system. From GPEC *Emplois types en dynamique* (ETED) was developed as a method that explicitly incorporated the dynamics of competence requirements (Mandon 1990, 1998; Mandon and Liaroutzos 1994).

The right for an individual to have a *bilan de compétences* (skills audit) undertaken by an independent organisation as a basis for personal development was introduced by the Act of 31 December 1991 (article L. 900–2). The Act specified that skill assessment should entail an analysis of 'occupational and personal skills; employability; and motivation' and should result in the definition of 'an occupational plan' and, where appropriate, 'a training plan' (Joras 2002). In the absence of a coherent agreed national framework for mapping competencies (or occupational and personal skills), individual assessment centres and training organisations were able to adopt their own, sometimes idiosyncratic, competence frameworks. The *bilan de compétences* was principally designed for career development (*évolution*) but the fact that it operated at the individual level and without a national framework, disconnected it from the competence tools that companies were using. Although it operated at the individual level, trade unions generally supported the *bilan de com-*

pétences as a developmental tool, but many remained hostile to GPEC because of its association with restructuring and reorganisation.

As competence became ever more present in HRM research and practice from the mid-1990s, diverse normative models and initiatives were apparent (Minet 1994; Parlier 1994). Competence became more focused on training and development (Dousset 1990), and the instruments for developing and measuring competencies became more prominent (Dietrich 2003; Klarsfeld and Roques 2003; Paraponaris 2003; Trépo and Ferrary 1997, 1998). Sector-level negotiations included discussions on future competence needs (Besuco and Tallard 1999), and competence-based pay was, for a while at least, introduced in some big industries (Brochier and Oiry 2003; Klarsfeld and Saint-Onge 2000; Marbach 1999).

The French version of the learning organisation, the *organisation qualifiante* (Zarifian 1999a), involved analysing the knowledge and skills that underpin work tasks and designing training to develop them, so was clearly linked with GPEC. The introduction of management by competence has always focused on performance, and productivity improvements (Bataille 2001; Zarifian 1999b) raised questions about the conditions under which competence development is associated with performance gains (Amadieu and Cadin 1996; Zarifian 1999a).

At the end of the 1990s, the employers' association *Mouvement des Entreprises de France* (MEDEF) began developing an initiative that was formally launched in 2002 as *Objectif Compétences* (MEDEF 2002). Organisational initiatives stimulated further academic interest, and another wave of publications, many of a more critical-analytical nature (Arnaud and Lauriol 2002; Aubret et al. 2002; Brochier 2002; Campinos-Dubernet 2001; Cavestro et al. 2007; Defélix et al. 2006; Dupray et al. 2003; Estellat 2003; Gangloff 2000; Klarsfeld and Oiry 2003; Leconte and Forgues 2000; Lepron 2001; Louart 2003; Martin 2003; Parlier et al. 1997; Pascail 2007; Quélin and Arrègle 2000; Reynaud 2001; Zarifian 2000, 2001, 2005; Zimmerman 2000), appeared. Whilst the rate of publication on competence has steadied in recent years, the French literature is very substantial and includes some of the most theorised and analytical writings on the subject.

17.3 Conceptual Approaches to Competence

The conceptual approach to competence in France is quite distinctive from the British and German models (Brockmann et al. 2009; Le Deist and Winterton 2005; Winterton 2009). Defélix et al. (2001) described the 'Anglo-Saxon' approach as analytically more precise and complex, particularly in relation to 'soft competencies' (social competence or behaviour), whereas Tremblay and Sire (1999, p.131) commented that this approach included both hard competencies (knowledge and skills), which they described as *compétences essentielles*, and soft competencies (behaviours, traits and motives), described as *compétences différentielles*. The French literature frequently conflates the (very different) British and American competence models and neglects more nuanced variants from other Anglophone

countries. French competence models are generally more comprehensive than Anglophone models, which hover between the extremes of American behaviourist psychosocial 'competency' and British functionalist occupational competence (although these very descriptions are somewhat stereotyped).

Dejoux (1999, 2001) notes that the French competence model is built on a conceptual triptych of *savoir* (*compétences théoriques*, i.e. knowledge), *savoir-faire* (*compétences pratiques*, i.e. functional competencies) and *savoir-être* (*compétences sociales et comportementales*, i.e. social or behavioural competencies). Tremblay and Sire (1999) equate *savoir-faire* with British functional competence and *savoir-être* with American behavioural competencies.

Some observers suggested that the triptych only influenced HR professionals and that competence had little impact on strategic aspects of organisations (Cazal and Dietrich 2003). Certainly competence featured only rarely in the management strategy literature in the early years (see Durand 2000b). However, in the past decade, companies have increasingly adopted more strategic approaches to competence management, applying GPEC extensively and using other tools developed from the *Objectif Compétence* initiative. State initiatives to promote regional industry clusters (*pôles de compétitivité*) have also focused the attention of regional authorities on strategies to attract, develop and retain core competencies for industries of strategic importance to the local economy.

In France, as elsewhere, competence-based approaches to education and training have been marked by contradictions and confusion, particularly at the outset before workable tools had been developed (Monchatre 2002; Paradeise and Lichtenberger 2001). Examining the logic of competence from an epistemological perspective, Haddadj and Besson (2000a) noted a polarisation into individual approaches, centred on the behaviour of individuals, and collective approaches that were more concerned with the collective building of competence in line with organisational needs. It is interesting to note that definitions of competence in France also exhibit two extremes: competence as a universal attribute, such as literacy, linked with the world of education, and competencies in terms of individual capabilities, in the work context (Klarsfeld 2000). Of course, the required competence of an organisation resides in the capabilities of its individual members: organisations per se cannot possess competence any more than they can exhibit any other human characteristic, and the term organisational competence, like organisational health, is metaphorical. Similarly, to distinguish competence as a universal attribute from competence in terms of individual capability in the work context is to create a false dichotomy: individuals need a particular level of education in order to develop specific competencies at work. What these distinctions reflect is the tensions between individual and organisational interests and between the worlds of education and work, which appear repeatedly in the French literature on competence. Zimmerman (2000) noted another apparent ambiguity: whilst the competence movement makes explicit recognition of the value of human resources, it has frequently been associated with attempts to individualise the effort-reward bargain. The historic national agreement of September 2003, described below, directly addressed these apparent contradic-

tions associated with the implementation of competence-based approaches in France.

Until the Organisation for Economic Cooperation and Development (OECD) launched its Definition and Selection of Competencies (DeSeCo) Project, competence had rarely appeared in educational discourse. The French Ministry of Education (2001: 1) prepared a report under the DeSeCo project 'to identify and describe national initiatives regarding the measurement and relevance of competencies in different areas of society'. The report was based on a seminar attended by public officials, mostly from the Ministry, in June 2001 at the Directorate for Planning and Development of the Ministry in Paris. Surprisingly, given that MEDEF had already begun preparing the *Objectif Compétences* campaign, there was no involvement of employers or trade unions. Despite the failure to involve the social partners, participants agreed that competence could only be defined in a work context and that competence requirements were a function of the organisation of work. Competence, they argued, 'does not exist in isolation, unrelated to activity; [but] in relation to context: competence is observable in a specific, well-defined context; [and] competence is a fusion of cognitive elements, know-how and relational skills' (ibid: 4). The report extolled the virtues of 'post-industrial' work organisation and argued that a competence-based approach would meet 'the current needs of organizations … [where] employees must adjust their work to different situations, work in teams, communicate, adapt and master a broader range of skills' (ibid: 5). The authors of this report expressed concern over the extent to which competence could 'replace the older concept of qualification, since evaluating competencies poses many more problems than assessing qualifications' (ibid: 5). Whether this comment reflected traditional attachment to qualifications or frustration that competence-based education would not be easy to introduce is unclear. Unsurprisingly, given the absence of representatives from the world of work, the report took a supply-side perspective and did not address whether existing qualifications adequately reflected the competence requirements of the labour market, the question that was frequently being posed by employers at this time.

The importance of cognitive and functional competence was readily apparent in France, but social or behavioural competencies (*savoir être* or *compétences comportementales*) were contested, particularly by the trade unions. The inclusion of attributes like teamworking and customer care was often questioned, partly because of the difficulties of assessment but also because these were seen to be serving a managerial agenda. Some trade unions blocked attempts to include social dimensions in competence frameworks inside organisations, fearing that management would use this as a means of extending control over worker behaviour. Indeed the competence movement, especially during the early years, was treated with suspicion by the trade unions and much of the educational establishment (Brochier et al. 2001). The *dirigiste* management style prevalent in France explains the unions' attitude, but paradoxically the inclusion of social competence could have stimulated debates about management style and promoted more consensual approaches.

17.4 Competence and the Modernization of Qualifications

Traditionally, there were a large number of qualifications in France, many of them sector specific, and the terrain lacked both transparency and transferability. As part of the *Modernisation sociale* initiative, recognition and certification of experience acquired at the workplace was discussed at national level in 2001. A system of accreditation of experience (VAE, *validation des acquis et de l'expérience*) was introduced in 2002, and this inevitably focussed attention on identifying existing competencies. The law required accredited competencies to be mapped to existing qualifications.

The January 2002 law also simplified the system of vocational certificates to make them more transparent and opened the possibility for access to higher qualifications without the need for school leaving qualifications. The National Commission for Vocational Certification (CNCP, *Commission Nationale de la Certification Professionnelle*), established to implement the changes and develop a national catalogue of vocational qualifications (RNCP, *Répertoire National des Certifications Professionnelles*), played a crucial role in bringing the social partners to a common vocabulary on competence, qualifications and training. The work of the five representatives from each side (employers and trade union confederations) was pivotal in establishing the basis for the national agreement on training in 2003. The officials involved in the 2003 negotiations were interviewed in 2007 in connection with activities undertaken since the agreement and their successors were interviewed again in 2014.

The *Accord National Interprofessionnel* (ANI) of 20 September 2003 was turned into law in early 2004 and translated into regulations towards the end of that year. The 2003 ANI, comprising 27 articles and running to 50 pages, is probably the most comprehensive national agreement on vocational training ever negotiated. Sector-level negotiations began in 2005 and company negotiations in 2006, which focussed attention on competence issues at sector and workplace levels (Le Deist 2009; Le Deist and Winterton 2012; Méhaut 2007). At sector level, observatories were established for forecasting occupations and qualifications (*Observatoires prospectifs des métiers et qualifications*), to anticipate future sector restructuring and the associated changes in skills needs and to organise training to address skills gaps. By March 2007, some 450 sector-level negotiations had taken place, and over 200 sectors had begun to produce results from the activities of the observatories.

At the organisational level, the law addressed the tension between the needs of individuals and organisations by requiring a company training plan (*plan de formation*) that had to be explicitly linked with the sector priorities for training established by the observatories. Companies now assess training needs in terms of competencies identified as priorities at sector level. An individual right to training (DIF, *droit individuel de formation*) was created, which along with formal opportunities for a *bilan de compétence* and validation of experience through VAE was designed to support lifelong learning and raise workforce qualification. Individuals were given a right to have a developmental appraisal interview (*entretien professionnel*) with

their line manager at least every 2 years to identify training and development needs; in many cases local negotiations increased this to an annual interview.

These developments have put competence at the centre of the reform of the training system, operating as a fulcrum between the individual and the organisation. Organisations use GPEC to forecast future employment and skills needs then formulate a training plan in line with sector priorities. Individuals have access to the *bilan de compétence* to aid career development and to the VAE for validation of experience to attain qualifications. Competence requirements relating to the changing circumstances of work are compared with the acquired competencies of individuals in the development interview which serves to reconcile the interests of the individual and the organisation and to identify training needs to be met by the *plan de formation*.

17.5 The Practice of Competence Management in France

The evidence suggests that competence management is more developed in France than in other countries, particularly in the larger companies. According to Zimmerman (2000), companies pass through three stages in introducing the 'logic of competence'. First an inventory of jobs is undertaken, with the jobs classified according to national agreements and linked to a competence catalogue (*référentiel*) that can be consulted by all employees. Each employee is located in this *référentiel* based on the nature of their tasks and the requisite competencies and qualifications. Finally, the position of an individual in this framework is used to establish their level of remuneration. Many sector agreements established competence catalogues, whereas Zimmerman noted that the second stage was usually a question of unilateral determination by the employer. The establishment of this third stage – and the anticipation of the dynamic career evolution of individuals – was, for Zimmerman, the essential prerequisite for embedding the logic of competence.

All companies adopting competence management must establish a competence framework, but the frameworks adopted are extremely heterogeneous (Dietrich 2003; Oiry and Sulzer 2002). The 'evolving social construction' (Gilbert 2003: 12) of competence management ranges from simply adopting the terminology to the pervasive and comprehensive embedding of competence in all HRM systems and processes (Defélix 2001).

Using data from the Ministry of Labour's REPONSE (*Relations professionnelles et négociation d'entreprise*) survey of about 3000 establishments, Colin and Grasser (2003, 2006) assessed the extent of the diffusion of practices associated with competence management. Proxy measures (evaluation of performance, appraisal interviews and above-average expenditure on training) were used because the survey did not include specific questions on competence management. They argued that these proxies constitute at least *necessary* conditions for competence management even if they are not necessarily a *sufficient* guarantee that the establishment is practising competence management. Establishments not demonstrating these characteristics

cannot plausibly be practising competence management, and even though the method risks over-estimating the incidence of competence management, on these criteria, fewer than 8 % of establishments were found to engage in competence management to any extent and just over 4 % were doing so in a comprehensive sense.

It would be surprising if there is such a small proportion of companies practising competence management given its importance in the academic and policy literature. Competence management was in its infancy when the REPONSE survey was conducted in 1998, and after almost two decades, competence management has diffused more widely through the economy. The incidence of competence management (as evidenced by the proxy measures) is highly sensitive to establishment size so that among establishments with over 1000 employees, more than one-third were managing competence to some extent and one-fifth of them comprehensively. Since larger companies invariably adopt new techniques before small firms, these findings could be indicative of the beginning of a more general trend towards competence management. Colin and Grasser (2006) also noted that the incidence of competence management is strongly influenced by sector and 'social climate'. Sectors with a more highly qualified workforce have a marked tendency to practise competence management. The Matthias Principle (the likelihood of receiving training increases with the level of qualification – see McCracken and Winterton 2006) could partly explain this, since training expenditure is one of the proxies used. The positive correlation between social climate and competence management could involve causality in either direction, rather like the association between training expenditure and firm performance.

Some of the earliest examples of competence management (Sollac-Dunkerque, Propharm, Crédit Mutuel de Bretagne and Renault) cited by Haddadj and Besson (2000b) were little more than attempts to identify and catalogue existing competencies and build frameworks to structure the findings. Brochier (2002) provided a more thorough overview of state of the art practices with reference to organisations in petrochemicals, chemicals, steel and automobile manufacture, as well as organisations in the service sector, including insurance, postal services and electricity.

A competence management system was introduced to aid the restructuring of postal services (Baraldi et al. 2002). The old framework of grades based on qualifications, which throughout the public sector was disconnected from the job occupied, was replaced from 1993 by a system based on actual function, and a system of evaluation was introduced that centred on individual competence. The change was accompanied by three initiatives to develop transferable competencies, promote inter-functional mobility and encourage customer service attitudes. First, using a classic Hay Andersen approach, the HR directorate adopted a competence model that included both the technical competencies (*compétences fonctionnelles*) necessary to undertake job tasks and the social competencies (*compétences comportementales*) concerning transferable knowledge, skills and behaviours essential for the relational and cognitive aspects mobilised in the work context. Second, an evaluation system was introduced based on an annual individual face-to-face interview with the immediate superior to review performance, to fix objectives for the coming year and to identify training needs for those who would be developed to assume

further responsibilities. Third, the Post modified the promotion system in line with the logic of competence by using aptitude tests.

The steel and automotive sectors were significant leaders in the competence movement in France. A sector agreement in the steel industry in 1990, the *Accord sur la Conduite de l'Activité Professionnelle* (henceforth ACAP 2000), established the logic of competence throughout the sector. In this landmark agreement, competence was defined as 'validated operational know-how', and unlike the introduction of GPEC in many sectors which individual employers did unilaterally, in the steel industry, the employers chose to adopt competence management and negotiate changes with the trade unions (Gavini 1993). The approach adopted in ACAP 2000 was clearly influenced by the negotiations, and whilst it was less directly linked to the economic context of the industry than earlier agreements designed to ease the restructuring process, that context was also important. The largest group, Usinor-Sacilor, operated at many sites all over France, so faced the added challenge of ensuring a coherent implementation of agreements locally.

Chatzis et al. (1995) examined the application of ACAP 2000 over a period of 18 months at the Sollac-Dunkerque site of Usinor-Sacilor, one of the largest steel plants in France, tracing the origins of the agreement to the development of a more flexible system of job classifications demanded by profound sector restructuring. Accelerated retirements had created serious skills shortages and highlighted skills gaps in the remaining workforce. By the mid-1980s, it was apparent that the traditional classification based on jobs was an impediment to dealing with the skills crisis, and the company began experimenting with a *Système d'Evolution des Compétences* (SEC), where the focus was on work activities rather than job titles. The adoption of SEC coincided with changes in work organisation, involving flexible work teams of multi-skilled (*polyvalent*) workers.

The prelude to SEC was a comprehensive functional analysis (*Méthode d'Investigation des Activités*or MIA) involving three stages: situating the work group in the plant structure according to its principal objectives; identifying activities essential for achieving the work group's objectives, based on discussions with the operatives; and analysing the content of each activity in terms of *savoir-faire* (know-how) and *savoir-afférents* (relative knowledge). Occupational groups (*emplois-types*) were identified in the process, providing the foundations for the SEC to promote the evolution of individual competence in line with the changing skills needs of the plant brought about by technological developments. Whilst the MIA was an important foundation, the adoption of the logic of competence in the SEC also involved identifying the required competencies for each occupational group; evaluating the required competencies against a classification framework; and evaluation of the acquired competencies of operatives. The gap between acquired and required competencies was identified through development interviews with immediate superiors, and then training and development plans were formulated to bridge the gaps. Chatzis et al. (1995) viewed ACAP 2000 as a contract between the organisation and the individual worker, noting that it improved communication between operatives and management and opened new opportunities for career development.

Kalck et al. (2002) revisited the framework agreement on competence introduced in the metal sector and noted that the agreement marked the beginning of an approach to managing and developing the workforce, by which they would be able to adapt to new production techniques. Comparing two sites, they found that the agreement was operationalised at different rates, with one putting development interviews in place 2 years before the other. In the first site, a local agreement concerning career development brought into play the competence logic, which in turn destabilised the pre-existing trade union balance. Management wanted to dissociate the competence strategy from development and reduce demands for training from the workforce. The agreement created divisions between the local unions and resulted in significant opposition because the adoption of competence was seen as part of a strategy to reduce labour costs, increase outsourcing and limit career development and opportunities for multi-skilling. At the second site, the competence logic was more clearly articulated by management in establishing the methodology for determining the *référentiels* (competence catalogues) and procedures for undertaking development interviews and validating competencies. Occupational groups were identified with a view to career evolution and the perimeter of jobs was enlarged. Local trade unions were involved in the process, which succeeded in rationalising the occupational structure from over a thousand different job titles in 1992–1933 to occupational groups in 1998. Even if the strategic objectives of adopting competence were identical at the two sites, management tactics were quite different, and as a consequence, trade union responses were also very different. The experiences of the two sites demonstrated the limitations of the sector framework agreement itself, bringing to the surface conflicts between career management and the management of work activities, as well as conflicts arising out of the restriction of general wage increases to those engaged in the acquisition of new competencies.

The automobile sector also took a lead in adopting competence management. Gorgeu and Mathieu (2000) associated the adoption of more rigorous recruitment techniques using competence frameworks with lean production and precarious employment, including the increased use of a peripheral workforce. Drawing on information from automobile supply chain companies over a period of 5 years, they found that frequent work reorganisation made it difficult for companies to maintain accurate job descriptions and concluded that competence-based approaches were particularly associated with positions that companies had difficulty in defining or whose future was uncertain. Often the posts involved a degree of multi-tasking and a wider range of responsibilities than traditional production workers. Yet these potentially multi-skilled (*polyvalent*) workers were not well remunerated. Social competencies were often highlighted in recruitment and selection, which made extensive use of psychometric tests and assessment centres. Temporary contracts were used like extended interviews so social and behavioural competence could be assessed in the work context.

Two years later, Colin and Grasser (2002) associated the adoption of competence-based management in the automobile sector with the introduction of new production methods designed to reduce the risks of total breakdown characteristic of the traditional assembly line.

Production changes required the development of 'industrial and individual competencies'. The industrial competencies required by the new production method focused on the articulation between the different programming and the improvement of programmes rendered obsolete by non-linear routing. The individual competencies were a function of the specific occupational group (highly skilled maintenance workers, skilled or semi-skilled machine operators, and less skilled workers associated with nonautomated tasks). Colin and Grasser (2002) noted that the adoption of competence management in the organisation began with the recognition of the need to develop new competencies for the optimal exploitation of the technology, which in turn necessitated identifying the required competencies and then generating, transmitting and diffusing them throughout the workforce. The conceptual separation of industrial and individual competence and the subsequent interaction between the two was a major innovation.

17.6 How the Competence Movement Changed Vocational and Professional Education in France

The interdependency of industries all over Europe and beyond required comparable schemes of organisation and qualification. The idea of qualification denotes all those skills that are objectively necessary to master the tasks are inherent in the work process. Competencies, on the other hand, denote the subjective prerequisites that employees possess and that enable them to meet the objective skill requirements.

The primary feature of vocational education and training is the goal of achieving domain-specific employability in the occupation one was trained for. This distinguishes vocational training in a fundamental way from any kind of school-based and academic education. However, many of the competencies acquired in one occupation cannot be transferred to another domain. The foundations of occupational competence are domain-specific knowledge and skills.

This results in a need to develop a qualifications framework and to relate the different levels of vocational levels to each other. Without this criterion, competencies acquired in dual courses of vocational education and training cannot be compared with competencies that emerge from school-based vocational education or university studies. The recognition of qualifications therefore takes place with reference to the context of the respective occupational domains (ITB Working Group 2008).

In France, it is virtually impossible to enter a trade without specific qualifications recognised by the state. In the French labour market, qualifications are everything and it matters where the qualification is gained. This focus on qualifications makes it extremely difficult to adapt to the changing nature of work. In recent years employers have tried to adapt their employees' training to labour market needs, whilst the social partners together with state agencies are in the process of reforming and rationalising vocational qualifications. The concept of *compétence* has

significantly supported this process, but qualifications are so entrenched in common practice that it is difficult for the logic of competence to flourish.

The concept of competence plays a significant role in the reform of training and qualifications: it was at the origin of VAE (introduced into French law in 2002), because recognition and certification of experience acquired at the workplace is centred on identifying existing competencies and the legislation requires that these be related to existing qualifications. This law was also supposed to help access to higher qualifications without the need for qualifications acquired at school.

The *Accord National Interprofessionnel* (turned into a law in 2004) also helped develop specific training in order to meet the need for certain forecasted competencies. For most companies, this new law has entailed assessing internal training needs in terms of competencies.

The main conceptual model of competence in France has shown to incorporate some of the determining features of the American, British and German approaches. As discussed previously, the GPEC approach was seen as a mechanism for replacing the logic of qualification with the logic of competence (Le Deist 2009).

In France, the educational model was based on state provision, consensual systems, Neo-corporatist, state-regulated, school-based skill formation model. It is in the process of developing a national qualifications framework which has to contend with an existing framework based on a formal educational hierarchy of qualifications related to duration of study rather than achievement of competence.

France follows a state-supported and regulated skills development model. There is a wide range of institutionalised forms and ways to acquire qualifications. It favours strong and rather strict unification of the structure and content of qualifications (Le Deist and Tūtlys 2012).

Since the introduction of VAE in 2002 and corresponding instruments facilitating individual rights in training, the notion of 'certification' has become enlarged and less dependent on formal training, although formal qualifications are still the major reference in the labour market (Maillard and Rose 2007). Although France continues to give weight to state-recognised qualifications, the European-led competence movement has changed the vocational and professional education in many domains.

17.7 Conclusions

This chapter has traced the emergence of the competence movement in France and the associated literature from the origins in the 1990s to recent developments. The main conceptual model based on the *triptyque* of cognitive, functional and social competence is the main distinguishing characteristic and represents a bridge between the British and German approaches. The French model has such logical appeal that it was drawn on heavily in establishing a European typology of competence, which in turn influenced the development of a translation device for competence and qualifications.

Competence was central to the reform of the vocational training system and the qualifications framework in France. France is probably the world leader in the practice of competence management, which started around 20 years ago with the development of instruments and techniques to map workforce skills and forecast future sector skills needs, and of associated mechanisms at the level of organisations to balance the needs for competence development of the individual and organisation. From limited beginnings with a few leading-edge sectors like postal services, steel and automobiles, competence management is now widely practised in public and private organisations and is increasingly seen as a key aspect of organisational strategy.

The *Accord National Interprofessionnel* of 20 September 2003 undoubtedly stimulated the diffusion of competence management. Competence is at the centre of vocational training and industrial relations: sector-level observatories regularly forecast future skills needs, and companies must address sector priorities in their training plans. In developing company training plans, managers must confront competence when addressing sector priorities articulated in such terms. Similarly, the obligatory development interview (*entretiens professionnels*), skills audit (*bilan de competence*) and accreditation of experience (*validation des acquis et de l'expérience*), are also competence-based. As more coherence has developed between the competence logic developed at sector level and activities at local level designed to reconcile the interests of the enterprise and the individual, so there appears to be more coherence in the way that competence is conceived in policy discourse and in the perspectives of the social partners.

It is important to make the caveat that the high level of theoretical discussion of competence in the very extensive academic literature is seldom reflected in the adoption of competence management practices, which are typically under-theorised. The *Accord National Interprofessionnel* of 2003 promoted the logic of competence, but competence needs are elaborated in detail at sector and firm level, where competence frameworks take a more pragmatic and ad hoc approach reflecting specific and relatively immediate needs. There is limited interfirm and especially inter-sector articulation in these diverse competence models, yet such engagement will be essential to facilitate the labour mobility necessitated by the current wave of restructuring (Le Deist 2013). In this context, it is important that the new national qualifications system being built from the technical work of *Centre d'Etudes et de Recherches sur les Qualifications* (CEREQ) and the political foundations of the CNCP provides a means for identifying common core competencies that will aid labour mobility and employability in the widest sense.

Each occupation has its state-recognised qualifications, which is coupled with a state-regulated education-led vocational training system (Le Deist 2009). Although professional diplomas and curricula in national education systems in France have been completely transformed and revised during the last 15 years, diplomas are designed to validate formal qualifications rather than experience, namely, a level of education rather than a degree of practice. In the case of engineers, the action is close to a competence-based approach related to the organisation. This indicates that a trend from a qualifications-based approach to a competence-based approach

can take place gradually and pragmatically without disrupting the principles of the traditional civil service in France (Horton et al. 2002).

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Chapter 18
Competence-based Approach in the Education Reforms of Lithuania and Estonia

Vidmantas Tūtlys and Olav Aarna

18.1 Introduction

The introduction of the notion of competence in vocational education and training (VET) curriculum design and training practices was one of the key factors in the reform of initial VET in Lithuania and Estonia that enabled transformation of the post-Soviet initial VET systems towards EU and market-oriented models of VET. Therefore, this chapter aims to explore and compare the introduction and implementation of competence-based approaches in initial VET and higher education, as well as in the reforms of the national systems of qualifications in Lithuania and Estonia. This comparison comprises an analysis of the historical context of the development of competence-based approaches in initial VET and higher vocational education, an exploration of the focus on competence approaches, as well as a review of the development of competence-based national systems of qualifications and National Qualifications Frameworks in Lithuania and Estonia. From a theoretical perspective, this chapter acknowledges the wide diversity in the definition and application of the concept of competence (Winterton et al. 2006; Weigel et al. 2007; Winterton 2009; Brockmann et al. 2009, 2011; Biemans et al 2009; Mulder 2014) and is partly based on the theory of institutional development of skill formation systems as proposed by Streeck and Thelen (2009).

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18.2 Implementation of Competence-based VET and Higher Education in Lithuania and Estonia

The competence-based approach to vocational education and training (VET) emerged in the post-Soviet reform of the initial VET system of Lithuania together with the implementation of the first steps of the initial VET reform. Post-Soviet reform of the initial VET in Lithuania after 1990 was very strongly influenced by the abruptness of institutional changes as a result of the sudden reconstitution of statehood. This circumstance left little space or time for incremental development of the original institutions and institutional models of VET. Besides, the urgency of reform was increased by the irrelevance of the legacy of the Soviet VET system to new social, economic and institutional conditions: a vast network of initial VET providers, low prestige of VET amongst youth, absence or lack of communication between initial VET providers and newly emerged market economy institutions. For these reasons the first stage of post-Soviet reform of initial VET was focused on institutional restructuring of the VET system and adjustment of VET curricula to the skills needs of the emerging market economy.

Reform in the field of VET curriculum design was impeded by lack of expertise and know-how, because in the Soviet period, this function was executed by the central expertise bodies of the Soviet Union. The problem was solved by delegating responsibility for VET curriculum design to VET schools. This approach was piloted for the first time in the EU PHARE support programme for reform of VET in Lithuania, which started in 1995, and was of crucial importance for the further introduction of competence-based approaches to VET curriculum design. In the execution of this programme, competence-based VET curricula were designed and tested in the 27 VET schools with the support of foreign experts. Absence of know-how and expertise in competence-based education amongst the local policy makers and VET providers implied rather intensive application of policy borrowing and policy learning approaches in the conditions of provided EU support (the PHARE programme). A competence-based approach in VET curriculum design was attractive for local VET policy makers and providers because this facilitated flexibility with reference to changing skills needs in the workplaces of restructuring economic sectors.

The application and development of competence-based national VET policy instruments started from the design and implementation of the VET standards launched in 1998. The introduction of these VET standards represented state-led standardisation of the curricula of initial VET and higher vocational education by using competencies defined with common agreement of stakeholders from the VET system and labour market. Competence-based VET standards were treated by policy makers and experts mainly as measures to ensure the quality of initial VET provision under conditions of very diverse capacities of VET providers in terms of teachers' qualifications, methodical provision, infrastructure and other factors. The main 'conductors' of the implementation of competence-based approach in the initial VET curriculum design were vocational teachers trained in VET curriculum

design by using functional analysis techniques. Therefore, VET teachers rather quickly became leading experts in competence-based curriculum design.

The institutional structure of design and development of competence-based VET standards was based on tripartite collegial institutions representing sectors of economy. Fourteen expert groups of economic sectors were established, each consisting of three representatives of employers, three representatives of trade unions and three representatives of VET providers. Activities of these expert groups in the design of VET standards were coordinated by the central group of sector experts and the Centre for Methodological Support of VET – an institution established by the Ministry of Education and Science. Despite formally equal representation of VET providers and social partners, in most cases the representatives of VET providers played a key role in the design of VET standards. The participation and role of employer representatives very often were limited to providing information on skills needs. Trade union representatives participated very passively mainly due to lack of expertise and know-how in the field.

The VET standard defines the standardised part of the VET curriculum (professional activity areas, competencies and training objectives) which is automatically transferred to the curriculum from the appropriate VET standard. The designers of curricula in the VET schools may include additional competencies to satisfy local needs. Both VET standards and training curricula are based on competencies – combinations of knowledge, skills and key skills applied in execution of the work tasks and processes. However, the VET standards to some extent integrate the competence-based approach with the input approach, because the competencies are split into training objectives – smaller units of learning (knowledge, skills, abilities) that are provided through subjects. The training objectives present clear requirements for the designers of VET curricula and teachers on what knowledge, skills and key skills need to be provided and developed for each competency. In this way training objectives act as a bridge between defined competencies and training input. The designers of VET curricula regroup and amend training objectives according to local labour market needs and link them to the training subjects.

In the design and development of the VET standards, local experts cooperated with foreign organisations, such as the European Training Foundation, which facilitated consideration of international experience in developing such competence-based instruments.

Looking at the standardisation approach used in the VET standards of Lithuania, two features can be highlighted: orientation to minimal common performance requirements and lack of attention to future skills needs. VET standards are oriented to minimal common requirements: they indicate what is obligatory and necessary to achieve for competent performance of activities. They do not foresee any excellence levels or steps which would define the standard of highest quality in performance.

Implementation of competence-based approaches in the practices of provision of vocational education and assessment of learning has been very diverse and to some extent fragmentary. Two developments in particular had implications for the development of competence-based approaches in initial VET: modularisation of initial VET curricula and introduction of apprenticeship as an alternative pathway of initial VET.

The main purpose of the modularisation of VET curricula is to increase flexibility of curricula to make them more adaptable to changing economic needs and to standardise the contents of curricula to enhance training quality and recognition of learning outcomes when moving between institutions. It is foreseen to prepare 40 modular training curricula in at least 25 sub-sectors of education (*Lithuania: VET in Europe – country report* 2013). According to the designed methodology of modular VET curricula, the module is designed on the basis of competency defined in the initial VET standard or sectoral-occupational standard. Competency has been chosen as a basis of module, because it provides more flexibility in the organisation of training and accumulation/transfer of credits. However, design of modules on the basis of competencies also implies certain risks related to quality and sufficiency of acquired knowledge and skills to ensure employability, employment quality and permeability with the other learning pathways. Modularisation contains certain contradictions between the strive to make the learning process more flexible and enhance learner-centred approaches on one side and the possible implications of this approach to the quality of provided knowledge and skills from the other side. It has important implications for implementation and development of new pathways of initial VET provision, such as apprenticeship.

The Law on the Amendment of the Law on Vocational Education and Training in 2007 legally introduced the option of a dual type of apprenticeship in the initial VET system of Lithuania. However, despite the competence-based orientation of VET curriculum design, the provision of training and assessment of learning, the implementation of apprenticeship in the formal VET system is very slow. There are examples of 'hidden apprenticeships' and implicit competence-based remuneration and career approaches in enterprises that recruit low-skilled young people or students of VET schools and centres, provide in-service training and then gradually increase complexity of their work duties and wages (Qualifications and VET Development Centre 2013). The regulation of provision of the formal vocational education issued by the Ministry of Education and Science in 2012 responded to this situation by providing the possibility for initial VET students studying in the school-based pathway to work during the training period and to use the right of individual preparation for assessment of competencies, as well as the right for recognition of competencies acquired in the workplaces. Implementation and testing of apprenticeship in the VET system started in the field of employment training. Seeking to ensure high-quality vocational training for unemployed and preparation of skilled workers needed in the labour market, four public employment training centres started to implement the ESF-funded project 'apprenticeship vocational training in the employment training centres' in 2013. Under this project short-term (up to 6 months) apprenticeship schemes are offered to young unemployed people (16–29 years of age) not engaged in any form of education and training. These experimental apprenticeship schemes are clearly competence based, but they are more appropriate for those who already have acquired a certain general education level and even vocational qualification. Apprenticeship in these schemes is treated as workplace-based learning for the acquisition and development of competencies needed for the workplace. Such an approach to competence development does not

completely match to more holistic and lifelong learning-oriented concepts of competence applied in the reforms of the national system of qualifications and in the Lithuanian Qualifications Framework discussed below.

As mentioned above, competence-based VET standards have been applied for curriculum design not only in initial VET but also in higher vocational education colleges (universities of applied sciences) established in 2000. College study programmes correspond to ISCED 5B level and present by themselves professionally oriented higher education study programmes leading to a professional bachelor degree *(profesinis bakalauras)* or this degree together with vocational qualification. Curricula in these study programmes are designed referring to the VET standards and Guidelines of Study Field Area, which makes them competence based, although the term 'learning outcomes' rather than competencies is used in the descriptors of study programmes.

The implementation of a learning outcomes approach in universities began with the implementation of the ECTS system through an ESF-funded project initiated by the Ministry of Education and Science in 2009. In the same year, learning outcomes were introduced in the study credit concept in the Law on Research and Studies. It can be noted that this new concept of learning outcome was dualistic, because the competencies developed in the study subject or module were expressed with intended learning outcomes and achieved learning outcomes as individual achievements of student (*Nacionalinės studijų kreditų sistemos koncepcija* 2012). The ECTS oriented national study credit system is based on student notional workload (volume of studies) needed to develop competencies and to achieve intended learning outcomes. The concept of competence used in the national conception of the study credit system is based on the concept proposed by the TUNING project and is quite similar to the concept of competence used in the VET system defined as a dynamic combination of knowledge, skills and values that are necessary to execute the activity in an appropriate manner. The National Study Credit Conception distinguishes two types of competencies – generic competencies and subject-specific competencies. As far as competencies are acquired by achieving intended learning outcomes, they become the measurable elements of competence.

The project *Development of the Concept of the European Credit Transfer and Accumulation System (ECTS) at the National Level: Harmonization of the Credit and Implementation of the Learning Outcomes Based Study Programme Design* suggested the analysis of the professional field as the first step for design of study curricula aimed to identify the list of generic and subject-specific competencies by actively involving employers, graduates and academic community (*Nacionalinės studijų kreditų sistemos koncepcija* 2012). It is anticipated that reference of study syllabi to competencies and learning outcomes should help resolve problems related to essential differences in the contents of study programmes providing the same type of degrees in the same study fields (*Studijų krypčių aprašų skirtingoms pakopoms kūrimo metodika* 2011). This problem was targeted by the introduction and implementation of the study field descriptors developed in the project coordinated by the Centre for Quality Assessment in Higher Education in 2011–2014. Study field descriptors provide the reference information for identification of the level of

provided higher education degree and qualification according to the national, European and sectoral qualifications frameworks. Unlike the concept of competence suggested by the Tuning project, where competence is the source of learning outcomes, in the descriptors of study fields, competence is only a part of learning outcomes, defining integrated application of knowledge and skills in concrete situations and contexts of professional activity (Studijų krypčių aprašų skirtingoms pakopoms kūrimo metodika 2011).

Although ECTS credits have been officially introduced in study programmes since 2011 and all higher education institutions calculate students' workload in ECTS credits, the complete reorientation of universities from input-oriented to 'competence-based' studies requires a change in mentality of the academic community as well as experience in the new approach.

The beginning of implementation and development of a competence-based approach in Estonia was initiated by the Estonian Chamber of Commerce and Industry in 1997. After abolishing the Soviet qualification system, including occupational qualifications, in 1991, developments in all sectors of formal education were quite similar to those of Lithuania described above.

The period 1994–2004 can be considered as the period of policy borrowing in the field of curriculum design. This process was facilitated by numerous PHARE (VET) and TEMPUS (higher education) projects, mainly concentrating on curriculum development. The modular competence-based approach to initial VET curriculum design in Estonia was being developed from 1994 by applying experience of curriculum design in Ireland and encompassed all initial VET programmes in 2001. Competence-based reform of the VET system led to the separation of provision of VET and awarding of qualifications. Until the introduction of competence-based qualification exams in 2003/2004, graduates of initial VET programmes obtained graduate certificates that did not attribute vocational qualifications. Competence-based vocational qualification exams were introduced in 2003/2004 and combined with VET school graduation exams (Grollmann and Ruth 2004).

After Estonia joined the European Union in May 2004, the development of competence-based approaches and practices in initial VET and higher education were executed in the framework of the Bologna process (higher education), the Copenhagen process (initial and continuous VET) and the development of the European area of lifelong learning.

18.3 Focus on Competence Approaches in Lithuania and Estonia

The emergence and evolution of the competence concept and competence approaches in the VET system of Lithuania are strongly related to the socio-economic development of society and institutional changes of the VET system. Looking back to the historical development of initial VET in Lithuania, the first

references to the term *competence* can be traced to the period of attempts to establish more systemic vocational training in the fields of agriculture and crafts after the establishment of the independent state in 1918. The press of the chambers of trade and crafts widely discussed the problems caused by the absence of state recognition of craft qualifications, arguing that it was one of the most important reasons for the low social status of craftsmen and poor quality of craft apprenticeships. In this discourse, qualification was treated as the main formal outcome of the learning and training process subjected to assessment. The concept of competence emerged rarely in this discussion and was mainly understood as formal authorisation of the persons and organisations to execute defined functions. For example, when discussing the order for issuing craftsmen certificates, Jodaugas (1937) suggested that issuing such certificates did not fit the competence (*kompetencijos*) of public labour inspectors and had to be delegated to a 'qualified' institution (*kvalifikuota įstaiga*). Another meaning of competence that emerged in this discourse was related to the requirements of knowledge and skills typical for the work. For example, the director of one craft school in the article discussing the problems of craftsmens' training and their qualifications claimed that the hasty and abrupt introduction of competence (*kompetentingumas*) requirements for the execution of work could endanger the status of experienced but illiterate craftsmen, who could perform in their craft but could not attain formal qualification due to the requirements of credentials of formal education (Gėgžna 1936). He suggested that such craftsmen should be permitted to practice their work in the limits defined by the outcomes of evaluation of their practical experience. Similarly the term of competence was used in another article discussing training of tradesman, claiming that it was necessary to make easier the access to licence for practicing the crafts to more experienced craftsmen by leaving them possibilities to execute the work in the limits of competencies (*kompetencijų ribose*) identified by the practical examination (Gėgžna 1937). It is interesting to note that already in this period two Lithuanian terms related to competence were applied interchangeably: *kompetencija* and *kompetetingumas.*

In the Soviet period (1940–1990), the concept of competence was understood as a field of activities in which a person possessed expertise, knowledge and experience and was not related to the concepts of qualification or skills (Laužackas et al. 2009).

The concept of competence as an expressed learning outcome emerged in VET policy and practices as a result of post-Soviet VET reforms aimed at reorienting the former Soviet school-based initial VET to the requirements of a developing market economy and democratic society. Initial VET providers and institutions responsible for the governance of initial VET and curriculum design accepted the 'behaviouristic' concept of competence typical of the Anglo-Saxon approach based on functional analysis of work tasks and functions. This can be explained by the strong influence of policy borrowing and, to a lesser extent, policy learning approaches typical for the first stage of the initial VET reform.

In this period an important semiotic challenge emerged in the application of the concept of competence due to coexistence of two terms in the Lithuanian language: *kompetencija* and *kompetetingumas*. According to Pukelis, *kompetencija* is the

literal translation of competence in the sense of the legal empowerment of an organisation or person to execute certain functions, while *kompetetingumas* refers to proven abilities of a person to deal with work (occupational) tasks in a real work situation (2011). Therefore, he suggests that the misleading concept of *kompetencija* should not be used and to focus on the concept of *kompetetingumas. Kompetencija* (competency) should only be used to denote requirements for person abilities defined in the occupational standards and profiles, whereas *kompetetingumas* (competence) is defined as a feature of a person consisting of abilities to perform and to solve problems in unpredictable working situations indicating the validity of that individual to occupy certain job positions. This explanation relates this dichotomy of concepts *kompetencija* and *kompetetingumas* in the Lithuanian language with the translation of the dichotomous concepts of competence and competency.

Laužackas (2005) and Andriušaitienė et al. (2008) also agree with such explanation of the origins of this dichotomy, claiming that the concept of *kompetencija* reflects the potential side of human activities, while *kompetetingumas* expresses the real side of demonstrated performance. *Kompetencija* expresses possessing an ability to perform certain work tasks or processes, while *kompetetingumas* defines the usage and expression of this ability in the practical activity. Therefore, the concept of *kompetencija* is more relevant to use in the vocational education, especially in the design and planning of vocational education curricula, while *kompetetingumas* is closer to the practice of professional activities, because it helps to characterise the capacities of persons to perform in different activities.

The dichotomy of the terms *kompetencija* and *kompetetingumas* is not a recent phenomenon and not confined to Lithuania. As noted above, these two terms could be met in vocational and crafts training policy discourse before the Second World War. It is interesting that very similar dichotomies of the concept of competence exist in the languages of other Central and Eastern European nations (Polish, Ukrainian and Russian). For example, Polish distinguishes the concepts *kompetentność* (competence), defined as a proven preparedness to work in the concrete field and ability to solve problems in the concrete occupation or professional field (Karpowicz 2006), and *kompetencje* (competency), understood as the set of knowledge, personal qualities, skills and adequate experience needed for the execution of a given function (Slawiński 2014). The term *kompetencje* is more used in the discourse of educational reforms. In order to solve the problems of comprehension of this term in the design of the National Qualifications Framework of Poland, it was decided to use the term *kompetencje społeczne* (social competence) instead of *kompetencje* (Slawiński 2014). This latter concept is defined as the ability to shape one's own development, as well as the autonomous and responsible participation in professional life and society, taking into account the ethical context of one's own behaviour.

A similar dichotomy of terms can also be found in the Ukrainian language. Golovan (Головань 2008) discusses the concepts *компетенція* and *компетентність* and defines the first concept as a certain norm of proficiency indicating capacity to resolve problems or undertake tasks and the second term as

assessed achievement of (or failure to achieve) this norm. This author claims that the concept *компетентність* is used to characterise the quality of a person which enables him or her to solve problems, make decisions and express opinions in particular areas of work. This quality is based on knowledge, awareness and experience acquired in social and professional activity.

What are the possible reasons of such a dichotomy of concepts related to competence? One possible reason can be literal translation of English terms of competence and competency during the post-Soviet reforms of education system (Pukelis 2009). However, it cannot completely explain the etymology of this dichotomy, because at least in Lithuanian the usage of both terms can be tracked in much earlier historical periods.

In the Estonian language, the notion of competence (*kompetents, pädevus*) also has dual meaning. On the one hand, competence is a set of tasks, rights and obligations given to a physical or legal person by a legal act. Competence gives discretion to perform some kind of legal action (as opposed to an obligation). Competence also includes responsibility for the results of these actions. On the other hand, competence is a combination of knowledge, skills, experiences and attitudes necessary for successful performance of work tasks. The latter definition is used in the Estonian Occupational Qualifications Act (http://www.kutsekoda.ee/en/kutsesysteem/oigusaktidkutseseadus). This dual meaning may sometimes cause confusion, although in most cases the meaning can easily be understood from the context.

The Occupational Qualifications Act defines occupational qualification as the official result of an assessment, received when the body that awards occupational qualifications decides that the person has the required competence in the occupation on the level determined in the relevant occupational qualification standard. The processes of developing the Estonian Qualifications Framework (EstQF) and competence-based occupational qualification system that started in 2005 facilitated clarification of relations between the notions of competence, learning outcomes (performance indicators) and assessment criteria, which are of non-hierarchical, network-type nature. The notion of competence used in describing a person's ability to perform work tasks also has a dual nature (see Fig. 18.1). From the point of view of society, in particular the labour market, competence is described as a set of necessary competencies or a competence profile. From the point of view of a person as a learner, competence as well as each one of the competencies is described through a combination of knowledge, skills and attitudes, usually described as learning outcomes (LOs).

Assessment of competence can be performed competency wise or throughout the whole competence profile. Proper assessment criteria and methods of assessment are attached to each LO. As far as the same assessment criterion and assessment method may fit for several LOs, and vice versa, competencies, LOs and assessment criteria form a network structure.

Conceptually, a qualification system can be described as an interface between society, particularly the labour market, and the system of lifelong learning. This is illustrated by a competence circle (see Fig. 18.2). In this interface expected competencies are extracted from the society (or labour market) and transformed into quali-

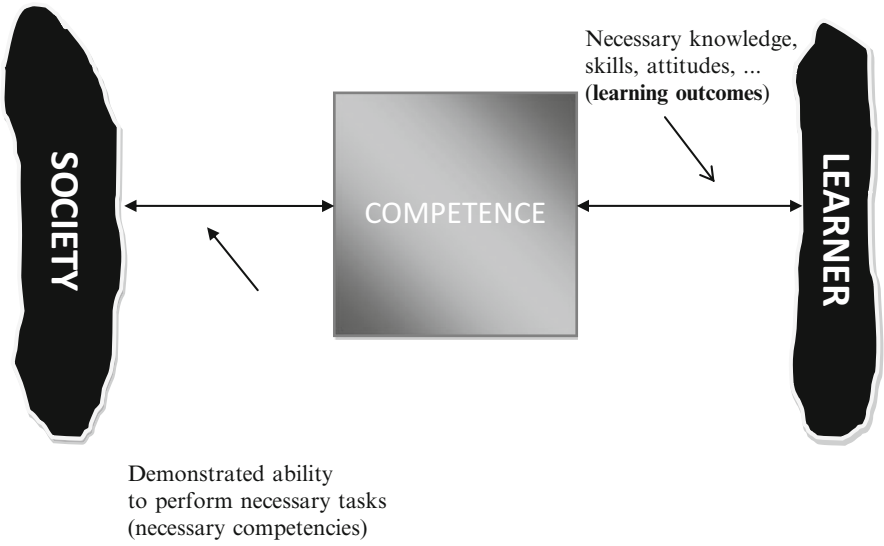

Fig. 18.1 Dual nature of competence (developed by Olav Aarna)

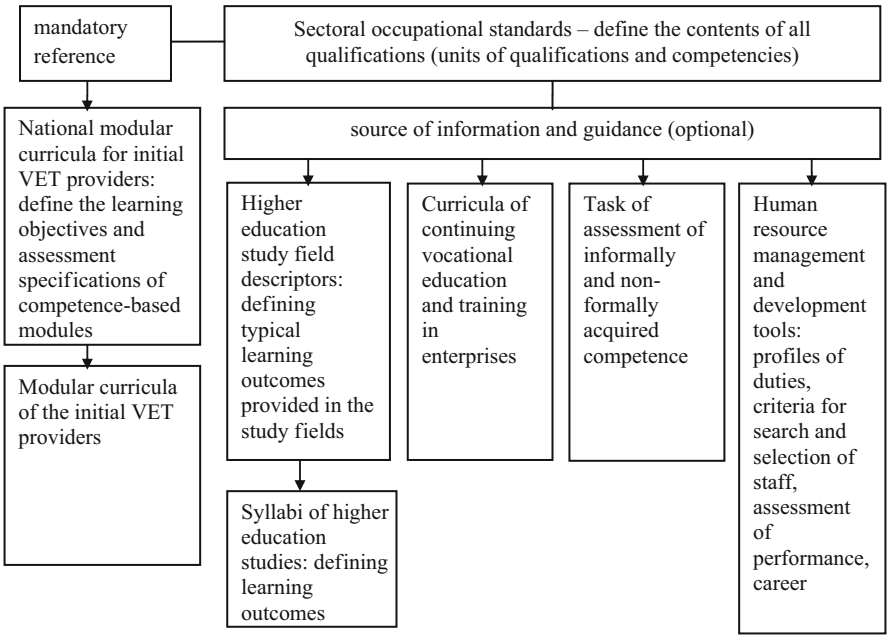

Fig. 18.2 Sectoral-occupational standards and their application fields

fication standards (particularly occupational qualification standards) and possibly national (core) curricula. On the other hand, actual competencies of persons are assessed, validated and certified.

In conclusion, it can be noted that in both countries the concept of competence has a dual nature expressing empowerment or discretion to perform the task, as well as the sets of knowledge, skills and abilities applied in performance of that task. However, reforms in education systems and national systems of qualifications both necessitate and facilitate clarification of these terms and their relationships with other applied terms, such as qualification, knowledge and skills.

18.4 The Role of the Concepts of Competence and Competence-based Approaches in the Reform of the National System of Qualifications in Lithuania and Estonia

Competence is one of the key conceptual elements of the Lithuanian Qualifications Framework (LTQF). The structure and logic of the LTQF level descriptors are based on requirements for performance of activities (in terms of complexity and changeability of activity and autonomy of performer) to competencies (Laužackas et al. 2009).

There are two reasons why the descriptors of LTQF are oriented to a competence-based approach: (1) this concept is familiar for the initial VET providers, assessment bodies and universities of applied sciences working with the VET standards and competence-based curricula; (2) the concept of competence is regarded as the optimal concept for articulation between the system of education and labour market. The familiarity of VET providers, assessment bodies and the universities of applied sciences with the concept of competence is related to comparatively positive acceptance and successful adaptation of competence-based VET standards and related qualifications. It creates favourable conditions for the introduction of the comprehensive competence-based NQF targeted to ensure the pathways of progression between different qualifications and their levels.

The first draft of the NQF level descriptors was prepared in 2008 by the group of experts from the higher education, initial VET and employers' organisations. It was strictly oriented to the coordination and referencing of vocational and academic (higher education) qualifications. Each level descriptor provided information on the requirements of the functional, cognitive and general competencies posed by the characteristics of occupations and professional activities. Consequently, the competencies acquired in general education were considered only as prerequisites for the acquisition or upgrading of vocational qualification, and all general education certificates were supposed to be referenced to the lowest (first) levels of the NQF. This approach was criticised by the national and European experts in the process of referencing the LTQF to the EQF in 2011–2012 by stating that orientation of the LTQF

only to vocational and higher education qualifications contradicted the principles of lifelong learning and permeability of different learning pathways declared in the European Qualifications Framework for Lifelong Learning (Kaminskienė 2011). As an outcome of the referencing process, the concept of qualification used in the Law on Education and LTQF was amended by indicating that competencies constituting qualification could be applied both in the professional activities and in learning. It implied introduction of the two main types of qualifications constituting the LTQF: qualifications needed for work (professional activity) and qualifications for learning.

Implementation of the LTQF in the national system of qualifications was regarded by the developers of this instrument as a process leading to the development of a new coordinative model of skills formation that would replace the outdated regulative model (Tūtlys and Spūdytė 2011). It was expected that implementation of the competence-based LTQF and introduction of sectoral-occupational standards would enable and enhance more active involvement of social partners and stakeholders in the design and development of qualifications, provision of education and training, competence assessment and awarding of qualifications.

Implementation of the LTQF is also directed to ensure application of competence-based approach in the design and development of qualifications through the introduction of sectoral-occupational standards that include all qualifications belonging to the national system of qualifications. Sectoral-occupational standards will serve as reference for the development of the different instruments of curriculum design and assessment of learning: standardised national modular initial VET curricula, higher education study field descriptors used for design and updating of the syllabi of higher education studies, curricula of continuing vocational training in the enterprises, instruments of assessment of informally and non-formally acquired competence (Fig. 18.2).

The design of competence-based sectoral-occupational standards in the sectors of energy, construction, hospitality, IT and transport demonstrated that development of such standards did not encounter significant methodological challenges and was positively accepted by stakeholders and providers of qualifications. Most of the methodological problems and questions were solved by internal discussions and agreements of experts from the sectors. One of the specific features of the design of sectoral-occupational standards is the combination of competence and work process approaches. This means that competencies are derived not just from isolated work tasks or functions (as was the case in the design of the VET standards) but from holistic analysis of the work processes that constitute professional activity, considering the context of the work process, work organisation, requirements for the work process and its results posed by the customers, enterprise and society (Spöttl and Ruth 2011). Introduction of this work process-oriented approach for the identification an d description of competencies leads to wider and more comprehensive descriptors of competencies that can grasp and consider not only current but also ongoing and future requirements for usage of knowledge and skills in the work process.

Observation of the design of competence-based sectoral-occupational standards in five sectors allows us to draw certain cautious assumptions about their possible impact on the development of national system of qualifications:

1. Development of work process and competence-based sectoral-occupational standards creates favourable conditions for reviewing and revising the structure and content of existing qualifications in the sectors by considering skills needs in the sectors and their potential changes. For example, design and development of competence-based sectoral-occupational standards permit to replace outdated narrowly specialised vocational qualifications with more universal and 'multi-skilled' qualifications. This was the case in the introduction of electrician qualification in the sectoral-occupational standard of the energy sector, where a wide and basic vocational qualification replaced narrowly specialised qualifications that had already lost their relevance and demand in the labour market. The old specialist qualifications included electrician fitter, fitter of the electric lighting equipment and electric power networks, fitter of electric equipment winding, insulation and maintenance, fitter repairmen of overhead electric transmission lines, etc. The competencies and units of these qualifications were integrated in the qualification of the electrician. The design of sectoral-occupational standards also facilitated the emergence or re-emergence of high-skilled vocational qualifications. This was the case with the introduction of qualifications of civil engineers in the construction sector. Currently there are only academic degrees in civil engineering according to the European Higher Education Area Qualifications Framework (bachelor, master and doctor in civil engineering). The occupational standard in the construction sector foresees introduction of qualifications of junior civil engineer (LTQF and EQF level 6), civil engineer (LTQF and EQF level 7) and senior (chartered) civil engineer (LTQF and EQF level 8) with requirements of professional experience in the award of these qualifications. There were introduced new vocational qualifications responding to labour market needs. For example, the occupational standard of the ICT sector foresees introduction of new vocational qualifications that are not yet provided in the initial VET system, such as junior software developer (LTQF and EQF level 4), junior test specialist (LTQF and EQF level 4), service desk agent (LTQF and EQF level 4) and associate of system administrator (LTQF and EQF level 4). Currently these qualifications are provided only by the enterprises of the sector through in-service training and recognition of experiential learning.
2. Development and implementation of sectoral-occupational standards also facilitate the involvement of social stakeholders in these processes, as well as developing their responsibility for designed qualifications leading to 'ownership' of these qualifications. Competence-based sectoral-occupational standards provide a lot of scope for systemic and comprehensive consideration of real skills needs in the work processes, thus making these standards applicable not only for communication of information on skills needs for curriculum design in the initial VET and higher education but also for human resource management and development in the enterprises and sectors (application for selection and recruitment,

planning and curriculum design of continuing vocational training, assessment of competencies and performance, remuneration policies, career management, etc.). These advantages were noticed by the employers' organisations, which motivated them to take active part in the process of development of standards and in some cases even to coordinate this process.

However, introducing and implementing these competence-based sectoral-occupational standards required important changes to the institutional framework of assessment of competence and awarding of qualifications, especially in case of introducing professional qualifications at the higher levels of the LTQF (6–8). Here the main challenge is a shortage of well-established and competent professional organisations or bodies that could take this responsibility. To solve this problem, the policy makers and stakeholders discuss the possibility of establishing multipartite collegial bodies or committees.

The development and implementation of a competence-based approach in Estonia is essentially the story of developing the national qualifications framework and qualification system. The creation of the Estonian Qualifications Framework (EstQF) started in 2005, when the minister of education and research established a broad-based working group with an assignment to analyse the first draft proposal of the EQF, the possibilities to link Estonian 5-level occupational qualifications framework to the EQF (established with the Occupational Qualifications Act adopted in 2001), and formulate suggestions about the development of the EstQF. The working group put forward the proposal of creating an eight-level comprehensive national qualifications framework. The proposal was supported by the employers' and employees' organisations, by the Estonian Chamber of Commerce and Industry, by the Ministry of Social Affairs and by the Ministry of Economic Affairs and Communications. Based on this agreement, another broad-based working group was established by the minister of education and research with the task of drafting a new Occupational Qualifications Act that would stipulate also the EstQF (Aarna 2011) (Fig. 18.3).

An eight-level qualification framework was established in 2008, with the Occupational Qualifications Act (http://www.kutsekoda.ee/en/kutsesysteem/oigusaktidkutseseadus). The EstQF consists of four sub-frameworks: for general education, for vocational education and training (VET), for higher education and for occupational qualifications (qualifications associated with a trade, occupation or profession resulting from work-based learning), with sub-framework-specific level descriptors. Unlike in many other member states of the EU, occupational qualifications are also placed into the EstQF and through that referenced to the EQF. This is made possible by the consistent application of a competence-based approach in the occupational qualification system, wide involvement of stakeholders and national governance of the system, ensuring the quality of the awarding of occupational qualifications and comparability thereof on the international level.

The creation and implementation of the EstQF followed the principles for accountability and quality assurance of qualifications laid down by the European

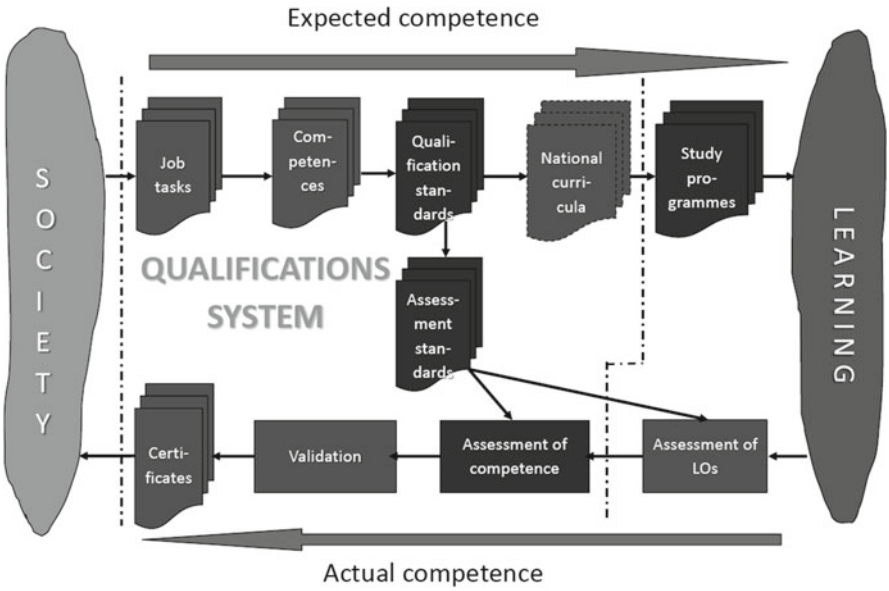

Fig. 18.3 Conceptual scheme of the qualification system in Estonia (developed by Olav Aarna)

Parliament and Council recommendation on the establishment of the EQF. Since the level descriptions of the EstQF are identical with those of the EQF, the criteria for referencing the EstQF to the EQF have been reformulated in terms of assigning the EstQF levels to the types of qualifications and the positioning of qualifications in the EstQF.

Qualification sub-frameworks are described in the corresponding legal acts and contain sub-framework-specific LO-based descriptions of qualification types. Level descriptions of sub-frameworks are defined in the corresponding national educational standards:

- National curriculum for basic schools
- Simplified national curriculum for basic schools
- National curriculum for upper secondary schools
- Standard of VET
- Standard of higher education

The process of establishing the EstQF and referencing it to the EQF provided an important impulse for developing the lifelong learning system in Estonia, for the establishment of the national qualification system and a quality assurance system for lifelong learning. In the course of this process, a remarkable convergence inside the formal educational system (general education, initial VET and higher education) occurred, and the barriers between qualifications from the formal education system and from the occupational qualification system have been reduced.

There are two types of qualifications in the Estonian general education system:

- Basic education certificate
- Upper secondary general education certificate

Somewhat paradoxically national curricula for basic school and upper secondary school were competence based already since 1996. Expected LOs of these qualifications and respective national curricula (adopted in 2011) are based on competencies derived from the eight EU key competencies for lifelong learning. There are two types of competencies: general and domain specific.

General competencies comprise value-based competence, social competence, self-definition competence, learning competence, communication competence, mathematical competence and entrepreneurial competence.

The subjects with similar aims and content form a subject field which is targeted to support formation of the respective competence. Formation of these competencies is supported by learning the subjects of the same and other fields and extracurricular activities.

Uniform requirements for VET curricula and qualifications are regulated by the Standard of VET (SVET) (https://www.riigiteataja.ee/akt/128082013013) and the national curricula for VET (http://www.innove.ee/et/kutseharidus/kutsehariduserok) developed for the upper secondary VET qualifications. National curricula are drafted in co-operation with social partners and are based on occupational qualification standards, the Standard of VET and the national curriculum for upper secondary schools.

Competence-based school curricula are compiled for every individual qualification that can be acquired at a VET institution. The school curricula (excluding upper secondary VET curricula) are developed based on the Standard of VET and the respective occupational qualification standards. In cases where no such standards exist, the school must apply for recognition of the curricula by the social partners. Upper secondary VET curricula are developed based on national curricula.

The SVET stipulates that LOs of modules are described in terms of occupation-specific knowledge and skills, autonomy and responsibility, learning skill, communication skill, self-definition competence, operational competence, ICT competence and entrepreneurship competence defined as follows:

- Occupation-specific knowledge are facts, theories and practices of an occupation, vocation or speciality acquired through learning process.
- Occupation-specific skill is an ability to apply knowledge for performing tasks and solving problems; skills are described in terms of their complexity and diversity.
- Autonomy and responsibility describe to what extent the graduate is able to work independently and carry responsibility for the results of work.
- Learning skill is an ability to manage learning process using efficient learning strategies and proper learning styles.

- Communication skill is an ability to communicate in different situations and on different topics in oral and written form.
- Self-definition competence is an ability to understand and evaluate yourself, give sense to your activities and behaviour in the society and develop yourself as a person.
- Operational competence is an ability to identify problems and solve them, plan your activities, set goals and expected results, select proper tools, act, evaluate results of your action and cooperate with others.
- ICT competence is an ability to use ICT tools and digital media skilfully and critically.
- Entrepreneurship competence is an ability to take initiative, act creatively and plan your career in the modern economic, business and work environment using acquired knowledge and skills in different spheres of life.

The SVET describes the expected LOs of VET qualification types at the threshold level needed to complete a programme or a module (at the level of grade 3).

Qualification standards for the EQF levels 2 through 5 define-level specific competencies in terms of LOs.

Qualifications framework of higher education in Estonia is laid down by the standard of higher education, which establishes the following uniform requirements for studies at higher education level:

- Requirements for a curriculum, including requirements for a joint curriculum and requirements for studies and final paper or final examination
- The objectives of study and LOs (http://www.hm.ee/index.php?148583) and total volume of study, including the principles for recognition of prior learning
- General requirements for qualification of the academic staff
- List of fields of study and specialisations
- The curriculum groups in which the respective higher education institution (HEIs) has the right to offer programmes and award respective academic degrees and diplomas.

The LOs of higher education levels have been defined in compliance with the cycles of Qualifications Framework for the European Higher Education Area (QF-EHEA) and descriptions of levels 6–8 of the EQF. Nevertheless, the aim was not to copy any existing qualifications framework, but to develop the basis for improving the comparability of qualifications and streamline them with the needs of the society. It should be noted that QF-EHEA describes LOs on the average level or a normal achievement of a successful learner, while the SHE describes LOs on the basic level, i.e. any graduate must achieve these outcomes and achievement of LOs on the level above minimum is differentiated by grading. No attempt has been made to differentiate between professional and transferable LOs.

The Estonian qualifications framework of higher education comprises four types of qualifications: bachelor's degree, diploma of professional higher education, master's degree and doctoral degree.

Bachelor's degree and diploma of professional higher education have a different focus but they are equal qualifications of the QF-EHEA first cycle. Master's degree complies with the QF-EHEA second cycle and doctoral degree to the third cycle. All degrees offered by Estonian HEIs are end-of-cycle degrees, meaning that the LOs achieved are at the same qualification level as the corresponding level in the EstQF. This implies that there are no intermediate degrees in the Estonian higher education system.

The occupational qualification system in Estonia is a subsystem of the Estonian qualification system that links lifelong learning system with the labour market (see Fig. 18.2). The following principles have been taken into account while developing the occupational qualification system in Estonia:

- Stakeholders of the labour market are involved in all parts of the occupational qualification system: employers, employees, the state and trainers. Agreements are based on the co-operation of various stakeholders.
- The main concept of the occupational qualification system is competence that means the system is based on competence both conceptually and in reality.
- Occupational qualification system is built and operational as a quality assurance system.

The OQS consists of:

- System of occupational qualification standards
- System for awarding occupational qualifications
- Occupational qualification register

Occupational qualification standard (OQS) is a document which describes occupational activities and provides the competence requirements for an occupation. Development of OQSs in Estonia, which started in 1998, has gone through three generations. The third-generation standards are fully competence based. An OQS meets the following conditions:

- Is based on the job analysis or functional analysis
- Describes expected competencies as observable and assessable
- Defines the method(s) for assessing of persons' competence
- Defines the EstQF level of the respective occupational qualification

OQS consists of three parts. Part A of the standard (description of the occupation) provides an overview of the nature of work, major parts of work and tasks, necessary tools and work environment, including the specificities of work and describes the personal characteristics and skills-enhancing occupational activities. This is a source of information for a person selecting their occupation and shaping their career path. It also contains useful information for career advisers, labour market consultants, human resource managers and trainers.

The competence requirements presented in part B of the standard serve as a basis for the assessment of the applicant for the occupational qualification. These requirements are presented as descriptions of mandatory and optional competencies. Competence is an ability to perform a specific part of work or a task together with

the knowledge, skills and attitudes required for that. Proceeding from the nature of the occupation, its specificity and traditions, attesting competencies related to a specialisation or optional competencies may be the prerequisite for being awarded the occupational qualification. Part C of the standard contains general information.

Development of the occupational qualification system in Estonia took place in the framework of the European Social Fund (ESF) sponsored programme *development of the occupational qualification system 2008–2014*. During the programme, all OQSs were updated and the methods for assessing competence improved. At the moment there are more than 500 active OQSs. An option to award initial occupational qualification upon the completion of a VET or higher education institution is also provided.

Development and implementation of the occupational qualification system in Estonia has been initiated by the social partners and supported by the government. Thanks to governmental support, it has quickly grown into state-recognised qualification subsystem based on a strong legal framework. The competence-based occupational qualification standards are widely used as an input for curriculum development in initial VET and higher education.

The explicit division of the EstQF into four sub-frameworks has been spontaneous rather than pre-planned as a result of independent development of the four sub-frameworks based on different competence approaches. The general education system focused on providing general and field-specific subject competence, while the initial VET system curricula and qualifications focused on providing holistic general and vocational competence. The higher education qualifications framework learning outcomes are developed on the basis of the descriptors of the European Higher Education Area Qualifications Framework (Dublin descriptors), while the occupational qualification system is focused on developing occupational and work process competence. However, this does not mean that there is a very strict separation of these subsystems and does not, for example, exclude the possibility of adopting competence-based approaches in higher education. If there is an occupational qualification standard available on the EstQF level 6 or 7, fitting with a study programme envisaged, it has to be used as a competence-based starting point for the programme development.

Concluding this section, it is worth noting that the main difference in design and implementation of competence-based National Qualifications Frameworks in Lithuania and Estonia is related to the extent of unification and differentiation of these processes. In Lithuania, implementation of competence-based NQF are based on unified approach leading to the design of a comparatively unified qualifications framework without discerning explicit sub-frameworks at the beginning and emergence of the different types of qualifications (competence-based initial VET qualifications, learning outcome-based higher education degrees, higher professional qualifications) in the later stage of implementation of the LTQF and sectoral-occupational standards. Such development and implementation of the LTQF have led to the emergence of gaps in the LTQF, where certain levels of the framework remain ‘empty’ (level 5 of the LTQF), as well as the emergence of institutional challenges in ensuring assessment of competence and awarding of higher

vocational qualifications referenced to higher levels of the LTQF (6–8). Differentiated design and implementation of the NQF in Estonia led to development of different sub-frameworks containing different types of qualifications, as well as diverse institutions and bodies responsible for these qualifications. This has not, however, impeded transferability of pathways for acquisition of competence between the sub-frameworks and has helped to avoid the problems that typify Lithuania.

18.5 Competence Policy and Practice in the Educational Theory and Research in Lithuania and Estonia

The literature regarding competence-based vocational and higher education in Lithuania can be grouped into the following categories:

- Conceptual literature that discusses core concepts related to competence-based professional and vocational education
- Literature analysing implementation and application of competence-based approaches in the professional and vocational education
- Applied research and methodical literature providing different methodical guidance, tools and recommendations on the application of competence-based approach in the different practices of the provision of initial and continuing VET

The conceptual literature has played an essential role in introducing the concept of competence and explaining its contents in the reforms of initial VET, professional education and the national system of qualifications. This literature established the conceptual basis for the implementation and development of competence-based instruments of curriculum design, assessment of learning and awarding of qualifications. Laužackas (1997, 1998, 1999, 2000, 2005), Laužackas and Pukelis (2000) analysed and explained the concept of competence and its relationship with the concept of qualification by referring to the contradictions between objective and subjective aspects of professional activities and suggested the principles and methodical guidelines of competence-based VET curriculum design by applying the functional analysis approach. This research played a very important role in the design of the first competence-based instruments of VET curriculum design – VET standards. Pukelis (1995, 2009) analysed theoretical dimensions of the concepts of abilities, competence, competency, learning outcomes and qualifications, as well as exploring relationships between these concepts. Jucevičienė and Lepaitė (2000), Lepaitė and Jucevičienė (2002) analysed the structure of the concept of competence referring to the context of the model of activity and stating that competence is a hierarchical and structural construct. Jovaiša and Shaw (1998) analysed the concepts and types of key competencies referring to the Anglo-Saxon approach of categorisation of these competencies. The literature on the development of the national system of qualifications of Lithuania analyses and discusses the application of competence-based approaches in the design of qualifications,

provision of education and training, assessment of learning outcomes and awarding of qualifications and provides the conceptual underpinning of the competence-based National Qualifications Framework of Lithuania (Lietuvos darbo rinkos mokymo tarnyba 2008; Andriušaitienė et al. 2008; Lietuvos darbo rinkos mokymo tarnyba 2007). This literature refers to the instrumental character of the concept of competence and pays particular attention to structural relationships between competence and qualifications, as well as to the typology of competencies. Competence requirements originating from the specifications and characteristics of professional activities are suggested as key parameters for defining the levels of qualifications in the Lithuanian Qualifications Framework. The typical feature of this conceptual literature on competence-based vocational and higher education is theoretical discussion of the structure and contents of the concepts of competence, as well as on the typologies of competencies largely referring to the analysis of concepts and approaches existing in the other countries. Poviliūnas et al. (2012) notice that the development of the conceptual background of the national system of qualifications of Lithuania and competence-based Lithuanian Qualifications Framework can be attributed to positivist methodology and the structuralist approach of social research.

The literature analysing implementation and application of competence-based approaches in the vocational and higher education of Lithuania is not very abundant, and it is focused on the analysis and evaluation of the different aspects of application of competence-based approaches in the reforms of VET and practices of VET provision. Laužackas et al. (2004) evaluated the initial VET reform in Lithuania analysing the processes of this reform on the national, institutional and classroom levels. Their research demonstrated that the introduction of competence-based curricula in the post-Soviet initial VET reform significantly improved VET teachers' awareness of the fields of competence-based curriculum design and assessment of learning outcomes, but at the same time VET providers faced significant challenges in developing social partnership and involving social partners in these processes. This research also disclosed the rather modest positive impact of competence-based approaches on improving vocational skills of initial VET students in the initial stages of the VET reform. Laužackas et al. (2005) analysed the assessment of competence acquired in the informal and non-formal learning referring to the legal regulation, usage of standards, issues of social partnership, preparation of assessors and development of assessment methods. This research showed that assessment of non-formally and informally acquired competence faced difficulties and challenges related to fragmented and inconsistent legal regulation, insufficient quality and availability of VET standards, insufficient involvement of social partners in the assessment of competence, lack of awareness of their functions and responsibilities in this field and absence of unified and coherent system of competence assessment. Laužackas et al. (2009) analysed evolution of the competence concept in Lithuania from the post-Soviet initial VET reform to the development of the national system of qualifications. This paper demonstrated the variety of concepts of competence that emerged in the initial VET reforms and development of the system of qualifications, as well as the role the concept played in bridging the worlds of work and

education in the design of the Lithuanian NQF. Tūtlys and Spūdytė (2011) further analysed the role and place of competence in the design and implementation of the Lithuanian Qualifications Framework, showing that the competregulation, insufficient quality and availability ence-based Lithuanian Qualifications Framework and occupational standards are expected to improve the relationship between the worlds of work and education, but at the same time this process is very iterative and faces complex institutional and methodological challenges.

Methodical literature in the field of competence-based vocational and higher education consists of different methodological guidelines in the fields of VET curriculum design, occupational analysis and design of qualifications (occupational standards). Laužackas (1999) provided methodological guidelines for design of competence-based initial VET curricula using functional analysis. Laužackas et al. (2006) developed guidelines for the assessment of competence in the qualification examinations of initial VET graduates. Methodology of the design of occupational standards (2012) provides guidelines for designing of occupational standards by applying the work process analysis approach developed by German experts (Spöttl 2010; Spöttl and Ruth 2011) that makes it possible to identify competencies from the results of holistic analysis of work processes.

It is indicative that the database of publications (research reports, dissertations, etc.) on VET in the Estonian language (http://dspace.utlib.ee/dspace/handle/10062/40559/browse?value=kompetentsus&type=subject) contains fairly limited occurrences of the keywords 'competence' (23 times in 4 publications) and 'competency' (three times in three publications). Scientific literature on competence-based approaches in initial VET and professional education in Estonia is more focused on the different socio-economic and cultural factors and implications of the implementation of these approaches. Loogma (2004) analysed employers' discourse on competence development in the sectors of transitional economy and noticed a decreasing role of the initial VET providers and increasing role of continuing VET in enterprises in the field of competence development, as well as rather diverse and often contradictory understanding of competence needs in the discourse of employers and employees. Ümarik et al. (2010) identified a mismatch between learning outcome assessment mechanisms elaborated by schools and measures of competence needed by the enterprises, which demotivated employers to engage in such assessment. Rekkor et al. (2013) analysed the extent to which competence-based modular curriculum design in initial VET was accepted by teachers as innovative change, as well as the main challenges and difficulties faced by teachers in developing and applying modular curricula.

A survey of VET graduates in Estonia disclosed their satisfaction with competence-based initial VET provision such as apprenticeship (Nestor 2012). This survey also showed the problems of mismatch between competence developed in initial VET and the requirements of available jobs, as well as issues related to low economic benefits from acquired competence and qualification for some groups of learners (e.g. women) in precarious jobs. The survey of employers showed that they are willing to develop for VET graduates occupation-specific skills, but not their attitudes (Nestor and Nurmela 2013). The preferences of employers in recruiting

VET graduates depend on the type and features of job position – in the case of technically sophisticated occupations, the respective occupational qualification is the most important prerequisite for hiring, while in other job positions, personal characteristics and social attitudes are considered the most important.

In summary, it can be stated that the competence-based approach in initial VET and higher education has been one of the core topics of VET research in Lithuania, whereas it has been a rather peripheral topic in VET research in Estonia. Researchers and developers of VET in Lithuania have paid more attention to methodological issues of competence and competence-based approach in VET curriculum design and development of qualifications, while VET researchers in Estonia have focussed more on studying the impact of this approach.

18.6 Conclusions

The concept of competence was introduced in the education systems of Lithuania and Estonia during a period of abrupt and radical socio-economic and institutional post-communist transition and took rather similar pathways of development. Competence by itself presented one of those very attractive and appealing conceptual backgrounds for the development of new systems of education and pathways of learning oriented to the needs of a market economy. Therefore it served as the core concept and background for the curriculum reforms in the initial VET and higher education in both countries.

The concept of competence has certain similarities and differences in both countries. The concepts applied in the discourse of education policy and qualifications are quite similar, expressing the articulation between learning outcomes and their application in assessing learners' performance. The main differences can be found in the semiotics of this concept. For example, the dichotomy of terms '*kompetencija'* and '*kompetetingumas*' reflecting duality of the concept of competence in Lithuanian and some other languages is not found in the Estonian language.

The pace of introduction and implementation of competence-based approaches in the education systems of Lithuania and Estonia is also different. The development of the competence-based approach in initial VET in Lithuania occurred under the existing institutional conditions and capacities of initial VET providers and social partners leading to certain compromises between competence-based and subject-based approaches (e.g. competencies in the VET curricula are split into training objectives – knowledge, skills and key competence, provided through subject-based training), as well as later development of competence-based occupational standards (started only in 2011). The introduction and development of a competence-based approach in curriculum design in Estonia was faster and more radical than in Lithuania due to the stronger initiative and engagement of employers and other stakeholders, leading to earlier modularisation of initial VET curricula in 2003/2004 as well as earlier implementation of the occupational qualification system and occupational standards in 2008.

Competence-based approaches in the design of qualifications have played an important role in the reforms and the development of the national systems of qualifications in both countries. In Estonia, the development of the competence-based qualification system was initiated by the social partners (the Estonian Chamber of Commerce and Industry), and supported by the government. With that governmental support, the occupational qualification system was developed into a state-recognised qualification subsystem, which was based on a strong legal framework. The development of the competence-based qualification system in Lithuania was more centralised (with a strong role of the governmental bodies) and unified with some features of the sectoral approach.

The research agenda in the field of competence-based VET and higher education in Lithuania is more focussed on initial VET and on a wide range of methodological issues which emerge from the competence-based approach, while in Estonia this agenda is more oriented towards the analysis of the outcomes and implications of the competence-based approach.

The Comparison of the implementation of competence-based approaches in the reforms and development of vocational and professional education in Lithuania and Estonia shows that, although the application of this approach in the transitional reforms is based on rather similar conceptual backgrounds, this implementation followed rather different institutional pathways and patterns.

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Chapter 19
Competence-based Education in the Italian Context: State of Affairs and Overcoming Difficulties

Marco Ronchetti

19.1 Introduction

As reported in the first Italian Referencing Report to the European Qualifications Framework (ISFOL 2014), Italy has officially adopted the definitions of *knowledge*, *skills* and *competence* given by the EU Commission in the context of the European Qualifications Framework:

- 'Knowledge' means the outcome of the assimilation of information through learning.
- Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. Knowledge is described as theoretical and/or factual.
- 'Skills' means the ability to apply knowledge and use know-how to complete tasks and solve problems. Skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments).
- 'Competence' means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development. Competence is described in terms of responsibility and autonomy.

However, although the notion of 'competence' has come onto the scene in its full glory, teaching by competence is still difficult, especially in the upper secondary school. Much has changed on paper, while in class, the modifications are not so clearly observable; a fact that inevitably evokes a quote from the novel 'The

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Leopard' (*Il Gattopardo*) (Tommasi di Lampedusa 1958): 'Everything must change so that everything can remain the same'.

To present the state of the Italian situation and the national debate around the application of the competence-based education (CBE) in schools, this chapter will briefly recount the evolution that the Italian school system has gone through in the last two decades, quickly describe the current school organisation, discuss the relation between school evaluation and CBE and examine in detail how the notion of competence is formally introduced in the Italian schools. Finally, it will discuss the efforts of introducing CBE in schools, overviewing the main ideas of a recent project aimed at pushing CBE in the first 2 years of high school. Special attention will be given to the VET area.

19.2 A Short Story of the Recent Italian School System Evolution

The Italian school system legislation has undergone several changes since the turn of the millennium: in the last 15 years, Italy has been ruled by seven different governments, four of which have performed a school system reform (Berlinguer in 2000, Moratti in 2003, Gelmini in 2010 and Giannini in 2015).

Before the new millennium, the Italian school was organised in kindergarten (not compulsory), 5 years of elementary school (primary), 3 years of middle school (first level secondary school or lower secondary school) and 5 years of 'superiori' (second level secondary school or upper secondary school). Superiori were divided into Licei (*Classico* and *Scientifico*), technical institutes and professional institutes – the last two belonging to the vocational area. Licei were aimed at forming the managerial class. The state dictated compulsory programmes for each discipline and each school level.

A first radical modification happened with the D.P.R. n. 275/1999, which stated that each individual school, while respecting academic freedom and cultural pluralism, should 'design and realise educative and training interventions, adapting to different contexts and in line with the objectives of the national education system': a concept that is known as 'Autonomia Scolastica' (school autonomy). School autonomy was meant to create educational and training interventions aimed at the development of the individual. It also aspired to adapt schools to local contexts, needs and economy, while respecting some general national guidelines. The final goal was to ensure the educational success.

Every year, schools must publish their formative objectives in the 'formative plan' (*Piano dell'Offerta Formativa*, POF), and every decision taken in the context of autonomy must be determined during meetings of teachers board and school board. By virtue of autonomy, schools can establish agreements with universities, organisations and associations to achieve specific objectives set by the POF, temporarily exchange teachers among them, perform didactic research, introduce methodological and curricular innovation and flexibly manage teaching periods. They are also responsible for training and upgrading the school staff.

The same leftist government introduced shortly after a second important modification known as Berlinguer reform (Law n.30 2000). In an egalitarian attempt, it transformed all the technical institutes into Licei, ending up with 40 different sorts of them. At the same time, it created a bridge between primary and lower secondary. The last was reduced to 2 years, and the following 2 years were to be common for all 'Licei', elevating the compulsory education age from 14 to 15 years. The new law gave rise to a vivid discussion throughout the country. Echoes of such discussions are reported in (Fiore 2001).

The reform also adopted the Bologna Process recommendation and changed the university organisation, converting it to the European setting based on bachelor plus master and on the credit system. Previously, the universities had no notion of bachelor's degree and granted a title after a 5-year course for most disciplines, with some based on a 4-year course.

The school part of the Berlinguer reform was short lived, as soon after its approval the Italian Constitution was changed (Constitutional Law n.3 2001). In this change, regions were granted the power to legislate in the field of vocational education and training, subject to the general rules of education, in an attempt to provide a stronger link between formative effort and territorial needs. The discrepancy between the new constitutional mandate and the old centralised approach, which had persisted through the Berlinguer reform, made it unavoidable to change again the school legislation. In the meantime, there had been a government change, with a conservative alliance in power. The following Moratti reform (Law n.53 2003) undid most of what Berlinguer had done for schools while keeping intact the modification of the University system. The middle school remained articulated on 3 years (as there had been no time to apply the Berlinguer reform, it was never actually reduced to two as planned). The plethora of Licei disappeared, and they were reduced to eight branches: artistic, classic, economic, linguistic, music and dance, scientific, technological and human sciences. It was attempted to constitute an education system articulated in high schools and vocational institutions of equal dignity, having different paths, as far as curricula and methods are concerned, but converging in seeking to ensure citizens lifelong learning. The compulsory schooling was raised to 16 years, with the obligation to have some additional form of education (such as training on the job) upto 18 years.

The vocational system was aimed at achieving educational, cultural and professional profiles that were valid both in Italy and in the whole European Union. The reform obliged the state to define a common core of content, skills and competencies set by 'essential services levels' (*Livelli essenziali di prestazioni*, LEP) and by 'minimum educational standards' (*Standard Minimi Formativi*, SMF). The details were delegated to the regions, each of which has the power to organise them, with the effect to enhance the local differences that characterise Italy, where most of the south is affected by an historical and endemic underdevelopment (see e.g. Braga and Checchi 2010; Benadusi et al. 2010). Flexible and personalised educational initiatives were to be collected in a personal portfolio describing the educational, cultural and professional profile (*profilo educativo, culturale e professionale* – PECUP). The PECUP was connected with the workshops for developing, deepening and

recovering learning (*Laboratori di Approfondimento, Recupero e Sviluppo degli Apprendimenti*, LARSA). This novelty was not welcome to the labour unions, which lobbied to make the PECUP an option (Sandrone 2008).

In a short interim (2006–2008) between two conservative governments, the leftist government Prodi, with Minister Fioroni, introduced two interesting novelties: the competencies recommendation (D.M. 139 2007 – this point will be discussed in more detail later) and the test of the National Institute for the Evaluation of the Education System of Education and Training (*Istituto Nazionale per la Valutazione del Sistema Educativo di Istruzione e di Formazione*, INVALSI). The test is administrated to students at the end of the lower secondary school with the aim to compare the schools throughout the nation.

The following reform, by Minister Gelmini (D. M. 9 2010), actuated by the conservative political alliance, institutionalises 'the model of competence levels' to be compiled by class councils at the end of the compulsory schooling period and decrees its use by the regional training institutions. Also, it introduces facilities to make it easier for students to change type of school during the first two years of the second cycle.

The last reform (Law n.107 2015, 'La buona scuola', leftist government Renzi, Minister Giannini) deals with several internal organisational issues but does not modify the overall didactic system, except for the introduction of compulsory working stages in the technical and vocational institutes.

In spite of philosophical and political differences, there is an ideal continuum among these major reforms of the Italian education system, which is the attempt to find inspiration from the directives of the European council. The notion of 'competence' is taken from there, as well as the idea that the school and university system should be transnational. Certification of skills in university courses was a crucial issue the Berlinguer reform and was refined by the Moratti reform that introduced the European Credit Transfer System (ECTS) and promoted lifelong learning. The Gelmini reform takes the move from the European Qualifications Framework for lifelong learning (EU Comm 2008) and attempts to enable mobility and to make lifelong learning more palatable. Certification of competence levels becomes compulsory for both primary and secondary school, even though, as discussed later, not without problems. A detailed, critical account of the Italian reforms between 2000 and 2010 is available (Briguglio 2011), which concludes its review by saying that 'talking of competencies is still like moving on an unstable terrain'.

19.3 The Present Organisation of the Italian School System

At present, the Italian education and training system is divided into:

- Preprimary school (ages 3–5), non-compulsory, lasting 3 years;
- First cycle of education, divided into primary school (5 years) and lower secondary school (colloquially known as middle school, 3 years)

- Second cycle of education, including upper secondary school (5 years) and vocational education and training (*Istruzione e Formazione Professionale*– IeFP, 3 or 4 years)
- Higher education, made up of university education, higher level arts and music education (*Alta Formazione Artistica e Musicale* – AFAM) and higher technical education (*Istruzione Tecnica Superiore* – ITS)

Full-time education is compulsory and free for 10 years for all children between usually 6 and 16. It includes the first cycle and 2 years in the second cycle. At the end of the compulsory education, schools must compile a 'competence balance' for the pupil (more on this point later). Oddly, the end of compulsory schooling (at the end of the 10th school year) does not lead to obtain a title (titles are given at the end of the 8th and of the 13th years).

The Italian VET offering is very fragmented. In high schools, it is based on two different pillars: technical instruction and professional instruction. The first is homogeneous throughout the country and it is based on a 5-year curriculum, which ends with a final exam (*Maturità*), which gives access to university. The second is delegated to the regions, and it is structured in a first 3 years chunk ending with a qualification title. A fourth year provides a 'Diploma': after the fourth year, students who want to continue their studies have access to a specialisation year or to an integration module which enables the access to a university.

The already mentioned body called LARSA allows passing from technical instruction to professional instruction.

Students in the professional track, who decide not to continue after the end of the compulsory schooling, can fulfil their right/duty to education, which extends to the age of 18, through apprenticeship, continuous training or private training. The VET offering is completed by Higher Technical Education and Training (*Istruzione e Formazione Tecnica Superiore* – IFTS), organised by the regions, often by using European Social Fund initiatives, and post-upper secondary and post-higher education vocational training. The whole Italian formation system is described in (ISFOL 2015). The VET framework is discussed in (Nicoli 2011).

19.4 School Evaluation and the Role of Competence

As said, the school autonomy introduced wide decisional margins regarding the educational and organisational choices. The risk of autonomy is self-reference. To avoid it, it was deemed necessary to introduce monitoring and evaluation, which were based on two principles: school improvement and school accountability.

The first is based on self-evaluation, complemented with an intervention of by external experts to help the teacher team to identify, through a reflection on the obtained results and on the strengths and weaknesses, those elements that characterise the school, both positively and negatively.

The second refers to a comparative evaluation (national and international) among institutions, regions and relations between institutions and regions. The aim is to statistically detect and quantify problems and added value and to find out situations of possible danger or excellence.

This second approach was delegated to the already mentioned Italian National Service for School Evaluation (INVALSI), which runs national standardised tests that were designed to obtain data useful for local and global comparisons.

Initially, the intent was purely statistical and the tests were not aimed at testing the individuals but the collectivity. In the school years from 2003/2004 to 2006/2007, the tested disciplines were Italian, mathematics and science. The surveys were carried out at the end of the second and fourth classes of primary school, the first year of lower secondary school and the first and third of upper secondary school. Starting from 2007 to 2008, the surveys focused only on Italian and mathematics, and classes are held in the second and fifth year of primary school, the first and third of lower secondary school and second year of upper secondary school.

An important novelty was introduced in 2009 (D.L. 213 2009), when, while continuing with the global tests, the assessment of the individual student was introduced at the end of the third year of the lower secondary school and is used as part of the formal student evaluation at the end of the first cycle. This turned out to be an essential ingredient, since it makes it impossible to ignore or overlook it. The individual test, along with the Italian and math tests, asks students to complete a questionnaire with the aim to collect data on their context (personal and family study habits and attitudes towards situations in school life).

The INVALSI tests are based on multiple-choice questions and on questions requiring a textual answer (short answer, unique open answer and articulated open-ended answer). Every single test lasts less than 60 min. The tests are inspired by the International Comparative Studies (OECD-PISA – see http://www.oecd.org/pisa/, IEA-TIMSS and IEA-PIRLS – see http://www.iea.nl/home.html) and do not aim at detecting specific knowledge or skills learned in school but are rather oriented at detecting competence, i.e. to examine how the student is able to use what he has learned in school to solve new and nonroutine problems, which may be encountered in everyday life, but were probably never discussed in school in that form. This feature is essential to avoid checking the simple mnemonic notions or the mechanical repetition of procedures (which unfortunately schools do much too often).

The questions require the deployment of more or less complex reasoning skills. For being so different by the traditional school assessments, the INVALSI test does not enjoy a good reputation neither among the pupils, nor, often, among the teachers. The national press echoed these moods. Trinchero (Trinchero 2014) offers a detailed discussion of the INVALSI tests and collected the most frequent objections. The most relevant among them are the ideas that such type of evaluation:

- Belongs to the Anglo-Saxon tradition and it is foreign to the national culture
- Does not respect the local specificity, being equal on the whole national territory

- Does not take into account the multiple intelligences 'à la Gardner' Gardner (James and Gardner 1995)
- Measures the product and not the process
- Is biased by a 'luck' factor
- Is too difficult
- Can be cheated
- Pushes a teaching method that prepares to this sort of tests

Actually, the last objection is seen by Trinchero as a merit, since preparing for the test means pushing a competence-based approach that becomes an agent of change (for the better) of the Italian school.

A similar role is played by the already cited OECD-PISA. It is a well-known international comparative survey, which takes place every 3 years in order to assess to what extent students who approach the end of compulsory education have acquired some skills considered essential for an informed participation to society, as well as to continue learning in education or work. Students' age is 15, which on the Italian average corresponds to the second year of upper secondary school: the last year of compulsory education. The areas investigated are reading skills, mathematics and science. Analysing PISA results, Checchi (2004) evidenced the impact of family on students' competencies, showing that a stimulating environment is strongly correlated with better acquisition of competencies. He also showed that students in the VET system have significantly worse performance in transversal competencies than students in non-VET schools and correlates that with a self-selection process that originates from the family environment. Finally, he reports a strong competence dependence on the territory, arguing that poorer regions with a less active job market end up preparing worse students, perpetuating the economical gap among regions. It has to be noted that Checchi's results are relative to pre-2009 PISA assessments, when the participation of the regions to the test was on a voluntary basis.

Since 2009, all Italian regions have their own representative sample, unlike the previous year. Analysis performed on the 2009 test does not contradict Checchi's results. Borrione (Borrione et al. 2011) published an extensive study on the results of PISA 2009 for the Piemonte region (located in the Italian northeast, bordering with France). Apart comparing the regional results with the other Italian regions and with other countries, they analyse various components (e.g. educational vs. professional institutes, immigrants' performance, etc.). In the very interesting last section, they investigate what school-related factors affect the success of the pupils. For instance, they try to find relations between the number of teaching hours in a discipline (e.g. math) and the success in the test, with negative results. They find instead a positive relation between a stimulating cultural environment at home and good test results. The most interesting part of the analysis is the one relative to metacognition. They discover a clear correlation between positive test results and the adoption of metacognitive strategies, such as the understanding the goals of learning and controlling what has actually been learned, returning on unclear concepts. The best scoring pupils are those who do not try to *store information* or to *link content*

between them but who seek to 'check if they understood' and plan properly their own study. With respect to these findings, they quote Michel De Montaigne (De Montaigne 1899), who wants his ideal student to be 'an able man rather than a learned man'. They conclude their analysis by stating that a school that will promote success is not one that offers much content, but rather a school that teaches 'how to study', helps students to control their own learning, stimulates the pleasure and the curiosity of reading and promotes the diversity of readings and develops the inclination to explore the world around us. Also, an effective school builds a good classroom climate, which is an important prerequisite for the establishment of learning. The role of the family is important in creating a positive attitude towards study and culture and in trying to create the conditions and the right environment for learning.

Actually, the quote of De Montaigne could continue, as he stated that one should choose a tutor with a 'well-made rather than a well-filled head (…) both these qualities should be required of him, but more particularly character and understanding than learning; and he should go about his job in a novel way'. A wonderful summary stating that to prepare competent students, competent teachers are needed, who use new ways to teach.

19.5 Formal Introduction of Competence in the Italian School System

In 2006, the EU member states developed the provision of 'key competences for all' as part of their lifelong learning strategies. To this aim, 'Key competences for Lifelong Learning – A European Reference Framework' was developed and approved as Recommendation of the European Parliament and of the Council in 2006 (EU Parliament 2006). It defines the well-known set of eight key competencies and describes the essential knowledge, skills and attitudes related to each of these:

1. Communication in the mother tongue
2. Communication in foreign languages
3. Mathematical competence and basic competencies in science and technology
4. Digital competence
5. Learning to learn
6. Social and civic competencies
7. Sense of initiative and entrepreneurship
8. Cultural awareness and expression

The member states adopted the European Recommendation and introduced the notion of CBE in their legislation but often with some modifications. This is the case of the Italian legislator. The already mentioned Fioroni Ministry Decree (DM 139 2007) introduced the key competencies in the school system but with

Table 19.1 Comparison between the EU key competencies and the Italian framework

Recommendation of the European Parliament and of the Council – Dec. 2006	Italian D.M. 129, 27 Aug. 2007		
Key competencies for lifelong learning	Cultural axes	Citizenship key competencies	
Communication in the mother tongue	*Languages axis*	*Communicate*	
Communication in foreign languages			
Digital competence			
Mathematical competence and basic competencies in science and technology	*Scientific and technological axis*	*Mathematical axis*	
Social and civic competencies	*Historical axis*	*Collaborating and participating*	*Acting autonomously and responsibly*
Cultural awareness and expression			
Learning to learn		*Learning to learn*	
		Acquiring and interpreting information	
		Finding links and relationships	
Sense of initiative and entrepreneurship		*Inventing and designing*	
		Problem solving	

relevant variations. To comply with the principle of 'school autonomy', the decree provides some recommendations, but then it leaves to the schools much freedom about how to implement them.

The decree splits the competence body into two sets: 'Assi Culturali' (AC, cultural axes, defined as 'cultural dimensions') and 'Competenze Chiave di Cittadinanza' *(*CCC, citizenship key competencies). AC broadly covers four disciplinary areas: languages, science and technology, mathematics and history. Each of them is articulated in three to four key competencies. CCC comprises eight key competencies, so that the total number of competencies foreseen by the Italian law is 22 (12 + 8), against the eight of the European recommendation. Apparently, in spite of the humanistic culture that is dominating Italy, the legislator forgot the lesson by the mediaeval philosopher William of Ockham: 'Entia non sunt multiplicanda praeter necessitate' (entities must not be multiplied beyond necessity).

Table 19.1, adapted from (Zanchin 2012), attempts to map the four AC and the eight CCC against the eight EU competencies.

The underlying message is somehow odd, as it suggests that the competencies related to the cultural axes are strongly linked to a disciplinary approach and have nothing to do with the other areas, while the EU spirit is the opposite: for instance, *every* teacher should be able to evaluate the ability to communicate in the mother tongue, not only the one who teaches the local language! Hence, the Italian declination of competencies, rather than pushing for an interdisciplinary approach, reinforces disciplinary teaching.

Other notable points are that the EU version mixes math and science, while the Italian one takes them apart, and that digital competence has completely disappeared from the Italian declination. Even the wording is ambiguous, as the axis notion hides the competencies in the details, leaving them in full evidence only in the CCC. The cast of the disciplinary dimension on the competence concepts clearly assigns the AC responsibility to the corresponding disciplinary teachers, while the CCC are sort of 'nobody's child', and are perceived as ancillary and less important, even though in 1999 a proposal was discussed (but not approved), to introduce a new discipline called 'Cittadinanza e Costituzione' (Losito 1999). Such interpretation is confirmed by the already cited Gelmini reform (D.M. 9 2010), which prescribes that the (base) competencies must be certified at the end of the 10-year period of compulsory schooling: CCC are not part of this certification! Hence, the hidden message is that 'they're not really important': what really matters is the disciplinary approach. Things are even worse than that. The competence certification is a due act, but it is performed in parallel to the classical, yearly student evaluation, which is typically based on the *knowledge* acquired by the student. Competence evaluation does not have any impact on the student's career, up to the point that many schools comply with the norm, but the competence certificate is not even delivered to students and families, ending up in an archive. Most students and families do not even know that the certification exists! In such scenario, most teachers are not eager to dedicate much time to this activity, so that in the end the 16-year 'competence' balance is (almost always) nothing but a trivial mapping from the result of traditional, content-based disciplinary assessments onto the corresponding 'competence box', as could be confirmed by several anecdotal observations of such behaviours.

To reinforce the message, as if it was not clear enough, the Ministry wrote that 'competence must be anchored to the mastery of content and of the heuristic disciplinary procedures … as opposed to the thesis that abstract transversal competences (which are always only nominal) make the learning content irrelevant' (free translation from the rather convoluted reform text). It is not by chance that we quoted Tomasi di Lampedusa in the opening…

In the midst of this 'let's pretend to' setting, teachers are constantly told that they should incorporate competencies in their teaching. A decree of 2012 says, 'The EU key competencies framework is the horizon at which the Italian school system aims' (D.M. 254 2012). Written and non-written indications are vague and contradictory: those who attempt to get a deeper understanding often end up being lost and confused. Moreover, as Pelleray states (Pellerey 2010), a suitable semantic and operative framework is lacking. Teachers understand that they are requested to adapt to a new paradigm, yet they do not understand how to get there (Parmigiani et al. 2014) and often not even where is 'there'. Bottani (Bottani 2007) even mentions a 'pedagogical tsunami' caused by the big but largely incoherent amount of work done on the notion of competence.

Another Italian problem is the structure of teacher formation. After having taken a master's degree, the future teachers must go through a specific postgraduate education. The specific form of these courses has been continuously changing ever

since 1999, when the *Scuole di Specializzazione per l'Insegnamento Secondario* (Advanced School for Secondary Education – SSIS) was first introduced. They became *Tirocinio Formativo Attivo* (TFA) in 2010 and *Percorsi Abilitanti Speciali* (PAS) in 2012. Without discussing the detail of this evolution, it can be observed that they all share a bipartite structure, with some teaching of pedagogical-didactic disciplines, and still a considerable amount of subject content (as if a disciplinary Master was not enough). Such structure ensures that the identity of teachers rests, even today, more on discipline than on specific aspects of the profession. The grouping on 'disciplinary classes' is prodromal of the difficulty of dialogue that often later occurs among colleagues teaching different disciplines and of the poor attitude of the average Italian teachers especially in the upper secondary school, to cooperate and pursue the learning objectives across multiple disciplines, which is typical of competence-based teaching (Batini 2015).

The resistance to a transition to competence-based education is not uniform throughout the whole school system. In the primary school, interdisciplinary teaching is favoured by the fact that there are only two teachers per class, rather than one per discipline, and the concept of competence is not foreign for most teachers. In the lower secondary school, the INVALSI test had a clear effect of giving a motivation and a push towards teaching by competence. In the VET world, the notion and need of competence are familiar to many teachers. Where the situation is really dramatic is rest of the upper secondary school (*Licei*), where the notion of competence only enters in the mentioned 16-year balance – with all the discussed problems. An important element emerging from various focus groups run with a upper secondary school teachers groups is the fact the final exam (*Maturità*, at the end of the secondary cycle) still has an old-fashioned imprinting and is definitely not based on competence, and, in large part, it assesses the acquisition of knowledge: hence, teachers obviously feel obliged to prepare students for that. This happens even though, already in 1998 (D.P.R. n. 323 1998), the article 1 of the law about the maturity exam mentioned the word 'competence', even though its definition was not yet crisp: 'The analysis and verification of readiness of each candidate aims at determining the general and specific knowledge, competence intended as the possession of skills, also of applied nature, and the acquired logical and critical processing capacity'. Also Roger Abravanel, known for pushing meritocracy in the Italian society (Abravanel 2008), identifies a weakness in the way the maturity exam is defined and performed and invokes the introduction of an INVALSI test also at the end of the secondary cycle (Abravanel 2015).

According to the interviewed teachers, another hurdle comes from the fact that the university admission exams are essentially based on checking bare knowledge. The consequence is that it is extremely rare that teachers even think of dealing with competence in the last 3 years of high school.

A heuristic indication of these trends emerges from a search for books on the Italian site of Amazon.com. Selecting books by using the keywords 'competenze' together with 'medie' (middle school), one finds (as of August 2015) 500 titles. 'Competenze Superiori' reaches 250 hits (mostly, if not all, for the first two years) and 'Competenze Primaria' 275. Considering that the number of books per class in

the primary schools is much less that for secondary ones, this naïve indicator confirms that the 'competence' concept is much less fashionable and accepted in high schools than in primary and middle school.

Hence, several years after the explicit introduction of the notion of competence in the laws which rule the Italian school system, a change in didactical practices is hardly detectable, at least in the Italian upper secondary schools.

19.6 Competencies in the Italian VET System

In this uncertain landscape, VET is getting less fuzzy indications. The guidelines for VET education – *Linee Guida per il passaggio al Nuovo Ordinamento per Istituti Professionali* (D.P.R. 87 2010) contain a section (1.5) where there is strong and unambiguous indication that education should be competence-based. In particular, it is stated that competencies are developed while solving problems and fulfilling duties which involve practical applications of knowledge and know-how, possibly while cooperating with others. Teachers must hence be aware of this while projecting didactic activities, which should have a strong laboratorial imprinting, and should cooperate among them and with students. The recommendation proceeds dictating that teaching should in large part project-based and gives rather detailed indications about competence evaluation. The document presents then an 80-page attachment, where competence, knowledge and abilities are reported for every professional profile and every discipline of the first two years of professional schools. Along this direction is also the attempt to define on a national basis the certification of competence. To reach this goal, the government defined a national repertoire of the professional qualifications and the minimum standards for achieving the certification. The issue and its implications are discussed in (Tessaroli 2014). However, as already mentioned, after giving the general guidelines, VET education is in large part delegated to the local governments of the 20 Italian regions. The central offices (ISFOL, Istituto per lo Sviluppo della Formazione Professionale dei Lavoratori) monitor the formative actions and produce annual reports (e.g. Bassani et al. 2015), which interestingly is also available in the form of OpenData (Bassani 2015).

However, the devolution to the regions ends up in a rather fragmented set of initiatives, generally having only local coordination. This implies that also the research in this area is far from being well established, sound and homogeneous: often initiatives and experimentations lack formal research reports and do not take the form of scientific papers. Frequently, results are presented and discussed in local thematic workshops and meetings, which do not publish proceedings in the form of papers; in many cases, only the presenters' PowerPoint slides are available. It is hence very difficult to have a global overview of the whole Italian arena. However, the following part of this section attempts to summarise some of the recently published results.

A detailed comparison among the competence models used in the Veneto region, the Italian national model and the French model is presented in (Nicoli 2012).

The comparison takes into account several dimensions. Among them are the following: how competence is defined, how close to the European model is the implementation, how competence are structured, what is their list and how they relate to content, how they are evaluated and certified, which methodology helps their introduction and what support is given to teachers. In summary, it is stated that the Veneto model is far better than the national one and that it is not too far from the French model, which is considered to be the best among the three.

A very interesting case study (Bischof et al 2012) compares a VET offering in the field of mechanical industry between Italy and Germany. Training of students of an institute in the Lombardia region and one in Sachsen (Germany) is evaluated in parallel, in a wide study. The investigation shows that better theoretical and practical competencies are achieved by students in the German system, even though there are some lights also in the Italian one.

Yet another comparison among the Italian and other European systems has been presented (Browne and Laurenti 2007). It is a much less deep work that takes into consideration the competence models in Italy (and in particular in the Piemonte region), France and Spain in the domain of the mechanical industry. The conclusion is that the three systems actually converged, thanks to the inspiring indication of EU.

The Ufficio Scolastico Regionale per la Lombardia published (USR Lombardia 2013) the output of an experimentation run over the previous few years in a school-work alternation context. The outcome is a set of methodological indications for competence-based teaching. It is presented in the form of a set of cards, which guide teachers though various phases. First, the target competencies are made explicit and then every teacher prepares his/her own teaching plan. The teaching plans for the same class are put together and reviewed by every teacher to check for overall consistency and equilibrium among disciplines. Corrections are made and another review is carried on. Teaching activity is then started and constantly monitored. Periodic adjustments and replanning are performed.

An extensive report (Careglio 2013) reviews some experimentation performed in the Regione Piemonte. The report also includes a theoretical contribution (Trinchero 2013), which deals with situated competence and gives some principles. It states that one should take into account the fact that the learning process is nonlinear, intentional, social, constructive, self-reflexive, situated and contiguous to other processes, which happen in ordinary life. Starting from this, Trinchero then establishes a template for competence evaluation. The report then gives account of about 20 good practices for competence certification, which were experimented in the field in various schools in the region, both in VET and non-VET education. Activities are described with the common structure defined by Trinchero, which includes target competencies, target students, activity description, phases and time plan, list of learning materials, expected results and evaluation grid.

A recent paper (Parmigiani et al. 2014) reviews the instructional and assessment strategies for competence development in the Italian upper secondary school. The work is performed in the Liguria region, with the involvement of 23 schools, 16 of which in VET (eight technical and eight professional institutes). The research questions were: Which didactic and evaluation strategies are deemed to be important

by teachers? Which ones are by the students? Which strategies are employed in practice? Results indicate that the strategies most used in VET are guided discussions, group work and project work. Role-play is used in professional institutes but rarely in technical ones and mostly in foreign language teaching. Non-VET schools tend to privilege metacognitive reflection. The authors report that female teachers use formative contracts more frequently than male ones. Finally, they observe that teachers are in general interested in competence-based didactic strategies but that often they have difficulties in understanding how to put them into practice.

An investigation on the PISA results limited to the 'Scuole Professionali' has been carried out by the INVALSI (Mattei et al 2009). The output of the study, which involved 21 schools in seven regions, collects and reports an extensive set of interesting analytical data but is lacking a global analysis, so that it is not clear what one can conclude from the work.

Bellini and Ravotto proposed (Bellini and Ravotto 2009) and experimented (Ravotto and Bellini 2010) the adoption of the European Certification of Informatics Professionals (EUCIP) certification programme in the Italian VET (technical and professional instruction) for the information and communication technology-related professions. EUCIP is a professional certification and competency development scheme, aimed at informatics professionals and practitioners. It consists of a core certification as well as specialised certifications for a range of competencies, which are set out in an array of job-specific profiles. It is promoted by the Council of European Professional Informatics Societies (CEPIS), a non-profit organisation seeking to improve and promote a high standard among informatics professionals in recognition of the impact that informatics has on employment, business and society.

19.7 Efforts to Facilitate the Introduction of Teaching by Competence in High Schools (In General)

A number of pedagogists are working for disseminating ideas and good practices in Italy through the publication of books, e.g. Castoldi and Martini (2011), Trinchero (2012) and (Batini 2013) and special seminars, courses or other events held in the schools.

An attempt to facilitate the introduction of teaching by competence led to a project called eSchooling (Chiozzi et al. 2014) (Ronchetti et al. 2015), which was launched in 2013 by Telecom Italia, the largest Italian telecom operator, together with three other partners: an editor (Edizioni Centro Studi Erickson SpA) and two small companies (Memetic Srl and ForTeam Srl). An interdisciplinary research team comprising pedagogical and learning theories experts, computer scientists and technologists supported the effort. The project was directed at the first two years of the upper secondary school. The target was believed to be important because it presents a formal obligation to deal with the competence notion even though the

duty often eluded, as discussed above. Moreover, while Information and Communication Technology (ICT) has been applied over the last two decades to various aspect of school life (e.g. with Learning Management Systems, Learning Object Repositories, Interactive Whiteboards, Teacher's Electronic Diaries), it seems that no relevant effort has been dedicated to using ICT to favour and support CBE, which means that there might be a business opportunity. The projects goals were to deliver deploy and experiment in schools a cloud solution to support all the actors (teachers, students, families and school managers) in the transition to and in the application of CBE.

The legislative constraints prescribe that:

1. For every class, every teacher has to prepare, at the beginning of the school year, an overall plan of what they intend to do. The plan must include the competencies they intend to develop.
2. At the end of compulsory schooling, which usually coincides with the end of second year of high school, a competence balance document has to be prepared. As already mentioned, this document is often archived even without a communication to the family.

The software, a web app living on the cloud, begins by helping the teacher to prepare the initial plan. It provides a taxonomy of competencies, starting from the European key competencies and decomposing them into lower granularity (sub-competencies). The teacher can include them in her/his plan simply by browsing the taxonomy and selecting the relevant competencies he/she intends to develop. Once this operation is done, not only the plan has been prepared but also the system has learnt the teachers' declarations. It uses them later, during the school year, to proactively remind the teachers about them and to invite them prepare activities, which typically span over several teaching hours. A wizard assists in this phase, requesting the teacher to identify sub-competencies related to the activity. Activities usually include educational resources, which can be accessed and shared over the Internet or in the eSchooling repository and generally end with an assessment. Since eSchooling knows about the sub-competencies related to the activity, it can propose rubrics, an evaluation technique especially suited for competence evaluation, e.g. (Goodrich 1996) and (Panedero and Jonsson 2013). eSchooling rubrics can be used as proposed by the system or modified by the teacher. The resulting evaluations are kept in the eSchooling databases. These data play an important role, as they can generate graphs, such as radar plots, which are shown to students for prompting metacognitive reflection, to families as a monitoring and diagnostic tool, to school directors to oversee the students performances at individual and at different aggregation levels and to monitor the adoption of CBE by the teachers, e.g. in terms of use of the number of competence evaluations tracked, activities recorded into the system, etc.

Moreover, the system can detect discording evaluations on the same competence: each competence, being transversal, can be evaluated by more than one teacher, and it may well happen that two different teachers and up with radically different evaluations. In such cases, the system can proactively solicit interaction among the

involved teachers, indicating the problem. Hence, instead of finding such discrepancies at the official overall evaluation meetings (at midyear and at the end of the school year), when it is too late, they are immediately discovered. The alerted teachers are suggested to meet and discuss the issue. This also breaks the isolation in which teachers typically work and favours cross-disciplinary cooperation.

At the time of the final competence balance, the system elaborates a 'draft proposal' based on the collected evidence. Since possible conflicts were already indicated during the year and the proposal is based on the evidence coming from all teachers, reaching consensus is, at least in principle, easier and quicker.

The eSchooling solution hence helps teachers in:

1. Defining learning objectives related to key competencies to guide their teaching
2. Planning competence teaching
3. Designing and assigning activities in the CBE spirit
4. Accessing and sharing educational resources
5. Accessing and sharing best practices
6. Performing competence evaluation
7. Cooperating with colleagues

The project is fully aligned with the final recommendations of the European project, KeyCoNet – Key Competence Network of School Education, which was released in December 2014 (Looney and Michel 2014). The most relevant of these are:

1. 'Teachers need to have clear guidelines, access to appropriate tools and materials and exemplars of effective practice'.
2. 'ICT should address both the technical and pedagogical aspects in depth. Investments in research and development as well as in identifying effective support tools will be important'.
3. Among other factors, CBE involves:
   (a) A greater emphasis on interactive learning environments, presenting learners with open-ended problems and challenges. Learners may debate and test ideas, work in teams and access online platforms for collaboration
   (b) New approaches to assessment, including classroom-based formative assessment and summative assessments that provide information on learners' understanding of interconnections and processes (rather than fragments of knowledge) or ability to perform complex tasks
   (c) Relevant use of ICT to support collaborative work, provide access to educational resources, track learner progress and assess higher-order thinking.
4. 'Teachers are often isolated in their classrooms and have few opportunities to exchange ideas and insights. Teacher networks (…) may support the development of learning communities and may also stimulate innovation'.
5. 'Qualitative and quantitative data on learner and school performance will help school leaders to identify what is working well and where adjustments may be needed'.

Also, the eSchooling approach turns out to be coherent with most of the educational design principles for CBE, as outlined by Wesselink et al. (2007) and later by Sturing et al. (2011). Some of these principles are:

1. The identification of labour market/society relevant competencies and representative (vocational) core problems, inherently often multidisciplinary, as a starting point for curriculum design
2. Monitoring competence development via ongoing assessment for example by using assessment rubrics
3. Designing and learning in authentic learning tasks both in and outside school that integrate knowledge, skills and attitudes
4. Stimulating self-reflection and responsibility for students
5. Requiring teachers to adopt a variety of teacher roles, that is, the teacher is not only a knowledge expert in a specific discipline but also a coach of student learning, and, finally, paying explicit attention to a lifelong learning attitude and stimulating learning to learn.

The project was accompanied by an experimentation intended to validate it. The experimentation had limitations, which resulted in some shortcomings, which are discussed by Mana et al. (2015), and will need to be extended to ascertain to what degree the project is actually effective in facilitating the introduction of CBE in high schools. At present, a follow-up of the project is being dedicated to VET schools which also incorporates the management of project-based learning.

19.8 Conclusions

The Italian situation is, with respect to teaching by competence, rather complex. In spite of official declarations and formal requirements, the spirit of CBE has not yet pervaded the whole school spectrum. In particular, the inheritance of a cultural system that has been, and still is, solidly anchored in disciplinary approaches with a strong separation between different disciplines, which constitute an important hurdle. The problems are bigger where the discipline separation is more marked: hence, the worse situation is the one of the last 3 years of the non-VET upper secondary schools (*Licei*). The introduction of nationwide competence-based tests having a weight in the formal evaluation of students performance at the end of the middle school has helped introducing, at least in part, CBE in the middle schools. In elementary schools, where the disciplinary fragmentation is mitigated by the presence of only two teachers, CBE is implemented in a more natural way. The same holds for vocational schools, which historically are closer to the world of work, but while being present, the competence approach is less deeply rooted in the *Licei*.

To solve the problems, it would be necessary to have a more crisp and convinced indication by the politics, which, as discussed, is often ambivalent and ambiguous on CBE. Concrete acts should imply a radical change in the ‘Maturità’ exam, which the teachers who would be prone to adopt CBE find to be a deterrent. Such change

could at least include a test similar in spirit to the INVALSI test, which is run at the end of middle school.

Also, another big obstacle is the fragmentation of teaching: in high school, it is quite common to find teachers who teach a very specific discipline and hence have only very few (e.g. two) hours per week per class. Obviously, running CBE activities in such a short time is very difficult (Grazioli 2010). Moreover, such granularity makes it very complex to put in place interdisciplinary collaboration (as the number of 'heads' grows and communication grows factorially with that number). Fragmentation has another important impact: an effective introduction of CBE would be most effective if performed by all, or at least most, teachers of the same class. Individual teachers trying to introduce CBE in isolation in their own discipline encounter resistance by colleagues and cannot use an interdisciplinary approach.

Reduction of the fragmentation would have an important enabling effect. Of course, all this is very difficult. For the time being, one must rely on 'evangelisation' of individuals (at least where the problems are less dramatic) and on projects such as eSchooling. An important role could also be played by school managers, who by making good use of the school autonomy, could push CBE. The last school reform (Giannini), which was approved in the Summer of 2015, gives managers some more power to actually direct their schools, so, at least in principle, this could be good news.

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Chapter 20
Competence-based Education in China's Higher TVET: The Case of Shenzhen Polytechnic

Dayue (David) Fan

20.1 Introduction

Competence-based education (CBE) is one of the most important philosophies for education and training in the world today. As mentioned in Chap. 1 and elaborated in the chapter of Barrick in this volume, CBE originates from the USA and was developed in North America. Then it became popular in Australia and other western countries. The essence of this educational approach is that education and training programmes need to be '…more practice-oriented and relevant for finding or creating employment' (Mulder 2012). This approach is thought to be helpful to meet the current diverse social and individual needs. As a very important educational concept and a current development trend, CBE was introduced in China, especially for its Technical-Vocational Education and Training (TVET), since the 1990s, when China began to make considerable efforts to construct its modern TVET system.

During a period of over 20 years, China digested and practised this philosophy and has adopted and implemented it deeply in a holistic way in TVET. By aligning TVET to the real context of work life and the needs of economic development, it has improved the overall development of especially higher TVET effectively. Although quite a lot of problems still exist, China's TVET has become a complete system with both features of global educational development and Chinese features of its culture and tradition. Some educators refer to the present TVET system in China as a form of 'Integrated Education' (Lu 2014). This chapter presents a description of TVET in China of today and gives a picture of how 'competence' is understood and nurtured and what practices China has carried out to integrate CBE into its new

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TVET system. In order to discuss the topic clearly, the chapter will mainly concentrate on the development of CBE in the higher TVET sector as field of professional education, as it leads the way for all CBE application in China.

20.2 The TVET System and Polytechnics in China

The historical development of today's TVET in China can be traced back to the first technical school, which was established in 1866 in Fuzhou, in which practices of western countries were followed. In the process of its development, China learnt from France and the UK initially, then the USA and Japan. In the 1950s, after the foundation of New China (when the People's Republic of China was established in 1949), the practice of the USSR was taken as a model. The present TVET system in China began its reconstruction at the end of the 1980s after China opened up to the outside world again.

The present TVET system in China is composed of three divisions, i.e. primary, secondary and higher divisions. Like that in many other countries, TVET in the primary division consists of some elementary knowledge input and common practices to the pupils. More meaningful and concrete TVET is carried out in the secondary and the higher divisions.

The secondary TVET in China has the longest history compared with the other two divisions. In the current system, it mainly consists of 3 years of full-time senior secondary education (years 10–12) conducted in TVET senior schools, which enrol graduates from junior secondary schools, or of 1 year full time (post-secondary) for graduates of senior general secondary schools (Year 13). It typically provides students with Chinese language, mathematics, English language, computer application, physical and health training, physics and chemistry as the common elementary courses plus some specialized technical and vocational skills and theory courses. In addition, it also has the responsibility to improve general study and humanity qualities and general competence of the students through the education and training processes. In scale, it is almost half to half now with general secondary education. The annual employment rate of those secondary TVET students has been kept over 95 % in recent decades. Practically the secondary TVET helps young people, who are often seen as 'losers in studying' or 'problem students', have low self-esteem and have to rebuild their self-confidence and learn useful skills and competencies so as to become useful persons in the society (MOE 2012a).

Higher TVET is a new type of higher and TVET education in China since the 1990s. The purpose of establishing this education division was to make the TVET system complete by establishing an education subsector which nurtures higher level technical and vocational talents urgently needed by the rapid social and economic development. Historically, China's higher TVET has progressed through four periods in the past 3 decades: (1) establishment and gaining a legislative position in the education system (1985–1998), (2) expansion of scale and setting the direction for development (1999–2005), (3) construction of exemplar polytechnics to establish

the method and overall improvement of quality (2006–2011) and finally (4) overall and further development of the higher TVET and deepening the reforms for maintaining harmonious relations between higher TVET and secondary TVET (CNSAES and MyCOS Data 2012).

The higher TVET has now become an important part of higher education and of the holistic education system in China and as such is a form of professional education. Polytechnics (a name used in this chapter indicating all types of higher TVET colleges and institutions in China) form almost half of China's current higher educational institutions: there were 1145 universities (46.89 %), 1297 polytechnics (53.11 %) with 2,475,495 university students (42.45 %) and 3,355,628 polytechnic students (57.55 %) in 2012. Moreover, because of the expansion movements in higher education from 1999 to 2005, China now runs the largest sector of higher education (including higher TVET) in the world, with 231,783,315 students at all levels in 2012, thus having achieved the aim of popularizing higher education nationwide (MOE 2012b).

The polytechnics in China currently admit graduates of senior normal and vocational schools through National or Provincial Entrance Examinations of Colleges. They commonly offer 3-year full-time higher TVET programmes targeting at special technical and vocational skills and competencies for various practical working posts. The programmes are also aimed at developing generic competencies for preparing the students for better qualified and civilized citizens, while including professional knowledge, practicing related production and operation competences. The aim is to nurture first-line working and production talents and technicians.

The development of China's higher TVET is also a process of learning and adopting valuable experiences and practices from the advanced countries according to China's actual context. In the process, various concepts and practices from western countries have been studied: such as competence-based education (CBE) (Huang 1984; Lu 1997; Shi 1998; Xie 1998; Guan 1999; Yang 1999; Han 1999; Wang 2001; Meng 2002; He 2003; Feng and Lu 2003; Chen 2003; Tan 2003; Xu 2004, 2005; Yuan 2005; Lu 2006; Zhao 2008; Huang 2012 etc.), developing a curriculum (DACUM), work integrated learning, dual education system, curriculum design and development (CDD), task-based curriculum design, national vocational qualification (NVQ), national qualification framework (NQF), modern apprenticeship, technical and further education (TAFE), Kosen colleges of technology and so on.

As a new type of higher education, the polytechnics just mentioned have since the very beginning been given the authority to design and offer curricula and programmes according to the needs of local industry and communities. However, the majority of polytechnics started with compressing the 4-year university curricula into 3-year polytechnic programmes, because it was not really clear what higher TVET meant among them. Subsequently, the task of the polytechnics has been gradually modified from nurturing:

- 'Practical talent' (1988)
- 'Higher technology trained and specialised talent' (2000)
- 'Specialised and skilful talent with high quality and competence' (2004)

- ‘Talent with higher competence and qualities’ (2006)
- ‘Talent with higher competence’ (2011)
- ‘Talent comprehensively with advanced competence, qualities and innovative ideas’ (2012)

(It should be stated here that the above English-translated definitions are the writer’s personal translation of the Chinese language definitions by the China State Ministry of Education (MOE)).

The changes in the definitions of the tasks indicate transformations in the philosophy of running the polytechnics. Initially, ‘qualified talent’ just meant that the outcome of polytechnic education should be focused on certain technical and vocational skills and related knowledge to meet the HR needs of the first production lines.

The 2004 definition – ‘specialised and skilful talents with higher quality and competence’ – required not only skills as before, but, for the first time, the word ‘competence’ (技能) was used to replace ‘skill’ (技术) in the government documents in defining the task of the polytechnics. This means that the function of a polytechnic is comprehensive but not only for specific skills. The most important function of it is to educate qualified citizens with proper ethical values, ideology and concepts and with knowledge, know-how or more general the competence for participating in society and specialized clusters of daily productions or operations. With the development of economy and society, more comprehensive competencies are included in curricula of higher TVET since 2012, such as those pertaining to innovation.

20.3 Chinese Understanding of Competence

Correct understanding of the meaning of ‘competence’ is essential for implementing CBE. Similar to western countries, Chinese researchers had heated discussions based on the western studies on the theoretical definition of ‘competence’ as well (Shi 1997; Guan 1999; Wang 2001; Meng 2002; Feng and Lu 2003; Tan 2003; Xu 2004, 2005; Lu 2006; Zhao 2008, 2010; Huang 2012). Yet Chinese researchers have some obvious diachronical and national differences with foreign ones in this aspect (He 2003; Lu 2006; Zhao 2008).

At the initial stage, Chinese researches used to apply psychological and sociological definitions for the definition of competence. From a psychological perspective, the understanding of competence is that it is a personal feature that directly affects the efficiency and fulfilment of actions. And from sociological perspective, competence is the comprehensive quality of a person which consists of practical capability, personal power and proficiency in actions for properly dealing with tasks. It has a strategic function in achieving social intentions and exerts a positive influence on directing personal social development and life courses (Lu 1997; Shi 1998; CIVTE 1998; Han 1999). Guan (1999) further defines the concept following

the combined psychological and sociological perspectives and refers to competence as the capabilities a person has obtained, including physical, mental and even some non-physical nor mental ones, such as will, and moral character.

With the development of the economy, sciences and culture, intelligence is seen as a major constituent of competence nowadays. Competence seen as such includes capabilities for innovation, cooperation and professional dedication and is key important for competence-based competition (CIVTE 1998; Yang 1999; Guan 1999; Jiang 2008).Yuan (2005) stressed that competence in CBE should be understood as a characteristic of a person who can be responsible for professional actions in his/her dynamic social and vocational context. Such a competence commonly manifests itself in a kind of personal psychological preparation for facing the daily life in an active and positive way. And it is a kind of dominant survival capability in a recessive psychological situation.

The studies concerned have been used in the discussions to further develop TVET in China, which expanded to CBE curriculum development, teaching methodologies and assessment. The studies of foreign concepts, practices and contexts in China have brought about three categories of the concepts of competence, that is:

1. Reductionist competence which is conceived as a series of isolated acts relating to specific working tasks. They can be divided and measured.
2. Holist competence which takes abilities as general qualities. Such kind of personal quality is considered crucial for the efficiency of work. However, it overlooks the related working contexts.
3. Integrated competence which combines the general quality and the specific work contexts together and is the integrated outcomes of intelligence, professional knowledge, skills and attitudes (Xie 1998; Qian 1998; Han 1999; Huang 1984; He 2003; Liu 2003).

Among them, the third one is considered as the broad sense understanding of competence (see Chap. 1 of this volume to put this in the perspective of functionalistic, integrative and situated conceptions of competence). And it is more accepted and applied in China's present TVET practices. This integrated notion of competence is applied for defining what a person needs to be qualified for fulfilling a job and for adapting to transfer his/her capabilities to deal with a new and different context (Shi and Chen 2001; He 2003). In other words, it is a view competence which emphasizes the expectations which arise from the context of employment, including many non-skill-related capabilities which can be applied in different occupations and are transferable during labour mobility (Shi and Chen 2001; Chen 2003; Jiang 2008).

In higher TVET, Chinese researchers concentrate more on integrated vocational competence (IVC) (cf. Mulder 2014) and take this as a constituting feature of CBE. Such IVC is composed of professional, methodological and social competence. Here, professional competence refers to applicable and adequate professional knowledge, skills and capacities needed for vocational activities. Methodological competence comprises working and learning methods, which focus on reasoning, logic and innovation. And social competence refers to capability of graduates to

adapt to the social and community context while doing a job. Adaption and a positive attitude are the core of it (Zhou 2003; Jiang 2008) (see the chapter of Seeber and Wittmann in this volume for a further and western perspective on social competence).

In modern enterprises, holistically developed workers who possess 'systematic' competencies for carrying out innovation, planning and implementation activities, can effectively respond to assessments and have a positive outlook on teamwork are expected. Traditional operators or practitioners with fixed knowledge and a single competence are not wanted anymore (He and Zhang 2010). From the perspective of the personality (character) of the graduates, systematic competence can be divided into hard and soft competence (Guan 2007; Liu 2007; Li 2008a; Li 2008b; Song 2009; Xu 2009; Fan 2010; He and Zhang 2010; Xiong and Zeng 2010; Dai 2011; Ma et al. 2012; Zhou and Xu 2012; Peng et al. 2013; Zhu 2013; Huang et al. 2015; Liu 2015). Hard competence refers to professional knowledge, technical and professional skills and capacities that can be standardized, quantified, measured and copied and have tight relationships with intelligence. The level of hard competence proficiency has direct impact on the success of job performance. Complementary to hard competence, soft competence is noncognitive and non-technical but has close relationship with EQ. It is usually composed of professional qualities and generic-vocational competencies which are difficult to measure or standardize, such as vocational ideology, sense of responsibility, personality quality, context awareness, teamwork spirit, cooperative working attitude, social diplomacy and property, sociality ability, speaking in front of an audience, time control and innovation and problem-solving (He and Zhang 2010; Guan 2007; Xiong and Zeng 2010). The development of higher levels of soft competence usually takes a long time and tacitly transforms a person and has a hidden effect on his/her career development (Liu 2015). Considering the contents of soft competence, the term 'competence' is chosen here, instead of 'skills', as some researchers have used in their papers. The reason is that the majority of soft competencies are of personal quality, integrated with intelligence, tacit knowledge and respective psychological characteristics rather than simple skills.

In practice, My China Occupational Skills Research Institute abbreviated as 'MyCOS' has constructed a framework of generic competence for higher TVET graduates based on investigations in some China polytechnics and industry companies. It is composed of five categories of 35 fundamental capabilities to meet the requirements of the industries. The five categories are:

1. Understanding and communication
2. Scientific ways of thinking
3. Management
4. Application and analysis
5. Hands-on skills and know-how

The detail of the 35 fundamental capabilities is as follows (see Table 20.1).

Obviously, this generic competence framework is a comprehensive reconstruction of the competence domains defined in various research studies which have been

Table 20.1 MyCOS' generic competence framework for higher TVET

SN	Competence	Content Descriptions
Category 1. Comprehension and communications (7)		
1	Comprehension in reading	Comprehend the meaning of sentences and paragraphs in working documents
2	Proactive listening	Grasp the key points of the speakers and raise related questions
3	Effective oral communication	Transfer useful information effectively in communication
4	Proactive learning	Get inspiration from comprehension of information and use it in problem-solving and decision-making
5	Learning methods	Know the ways to select pedagogy and process for training and guidance
6	Understanding	Be sensitive and able to understand the intention of people's reaction
7	Serve the people	Be proactive in finding proper ways to serve others
Category 2. Scientific ways of thinking (4)		
8	Writing to the point	Transfer correct information effectively according to the readers' needs
9	Mathematical solution	Solve problems with mathematical methods
10	Scientific analysis	Solve problems with scientific principles and methods
11	Critical thinking	Use logic and deduction strategies analysis the suggestions, conclusion and solutions to problems
Category 3. Management (11)		
12	Effective auditing	Audit and evaluate the effectiveness of one's own, others' and institution's work and find out the proper actions for improvement
13	Coordination and arrangement	Adjust one's working arrangement according to the needs of others
14	Persuasion	Persuade others to change their minds and behaviour
15	Negotiation	Communicate for mutual understanding and agreement
16	Guidance	Guide others in the proper ways of doing things
17	Solution of complicated problems	Identify complicated problems and find out and assess the solutions based on searching for necessary information
18	Judgement and decision	Finalize the most proper plan based on the consideration of cost and effectiveness of different parties
19	Time management	Manage one's own time and others'
20	Finance management	Decide how to spend money for carrying out the work and implement bookkeeping and accounting
21	Logistic management	Require facilities, workshops and materials according to the special need of production, and supervise their proper use
22	Human resource management	Encourage, promote and guide others in the process of employing and recruiting proper personnel
Category 4. Application and analysis		
23	New concepts for products	Develop new products based on analysis of social needs and feasibility of production
24	Technique design	Design and refine facilities and techniques according to needs

(continued)

Table 20.1 (continued)

SN	Competence	Content Descriptions
25	Selection of facilities	Decide what kind of tools and facilities to use for the implementation of the work
26	Analysis of quality control	Carry out testing and checks of the products, services, and working procedures to assess quality and efficiency
27	Monitoring the operation	Monitor the instrument meters, controllers and other indicators to guarantee the proper operation of the machines
28	Operation and control	Control the operation of facilities and the system
29	Maintenances of facilities	Implement ordinary maintenance of the facilities, and decide the time and type of maintenance needed for the coming days
30	Diagnosis and troubleshooting	Diagnose the causes of improper operation, and troubleshoot
31	Systematic analysis	Be clear about the influence onto a system by a change
32	Systematic evaluation	Identify the methods and indexes for the system effectiveness assessment, and know how to adjust the systematic targets to improve the efficiency of the system
Category 5. Hands-on know-how		
33	Installation/capacity of doing work	Install facilities, machines, pipelines and programmes according to the special requests
34	Computer programming	Write computer programmes for various purposes
35	Repair of machines and systems	Use necessary tools to repair machines and systems

Source: MyCOS Research Institute (2009). *China College Graduates' Employment Annual Report*. Social Sciences Academic Press, Beijing, referring to Bartram (2005). With permission from MyCOS Research Institute & Social Sciences Academic Press (China)

cited. The framework was used for human resource development purposes in China's higher TVET context. The levels, content domains and purposes are specific. And this framework has been widely accepted by the polytechnics in China.

Huang, WX had implemented a research on Quality Model of New Type of Technical Talents among 2100 industrial and business companies in the Pearl River Delta Area, China, from 2007 to 2011. Its outcome provides us with the understanding of competence of those companies. In the research a questionnaire survey was conducted as an elementary strategy for information collection, which listed 18 optional competencies from the up-to-date competence data bank developed by the Chinese Association of Human Resource Development (http://www.hrdchina.org, only in Chinese). The 18 competencies were influential power, proactivity, judgement, project management, building relationships, professional learning, teamwork, analysis, innovation, implementation, service awareness, responsibility, communication, decision-making, organizing internal activities, confidence, building one's own confidence and self-control. The analysis of the data indicates that only six of the 18 competencies are highlighted by industry senior persons for graduates of higher TVET. They are proactivity (82 %), responsibility (73 %), teamwork, implementation (72.7 % each) and communication and professional learning ability (50 % each) (Huang 2010).

This result demonstrates that industries in China nowadays pay more attention to integrated competence i.e. not only to hard competence but also, and even more importantly, to soft competence of polytechnic graduates. Personnel with only technical and vocational and even professional competence, or with only simple structured competence, cannot meet labour market demands anymore. Industry wants those who have not only very good technical and vocational competence but also good work ethic, workplace adaptability, communication skills and active learning capacity. Graduates equipped with those competencies can be considered as being highly welcome by employers.

20.4 Theory and Practice of CB-TVET in Shenzhen Polytechnic (SZPT)

Shenzhen Polytechnic (SZPT) is one of the leading, pioneering and exemplary higher TVET institutions in China. Like many other similar polytechnics, it has studied different philosophies and strategies regarding TVET in developed countries for its own education reforming purposes and has implemented these. It actually functions as one of China's theory developers in higher TVET (Liu 2008, 2009, 2011; Liu et al. 2010, 2012; Zhu 2012; Li 2014; Li and Qing 2013). It has kept on modifying its operation model, including comprehensive CBE, to enhance the competence levels of their students. Since 2008, it has been practising a renewed philosophy for polytechnic institutions. This is referred to as the 'four closely associated bodies and four fields which are mutually promoted, while delivering higher TVET culturally, comprehensively and cooperatively'. In this education philosophy, the 'four bodies' refer to (1) the government, (2) TVET institutions, (3) industrial or trade associations and (4) enterprises, and the 'four fields' indicate (1) production, (2) studying, (3) research and (4) application.

The '4-body, 4-field' educational philosophy is aimed at external alignment of TVET. And delivering TVET culturally, comprehensively and cooperatively for 'nurturing qualified talents to the society' is aimed at internal education reform in the polytechnic. This view is given the name 'three kinds of education' for TVET.

In the 'three kinds of education' for TVET, 'culture' refers to cultural and academic content, including morality, literature, history, philosophy, art, languages, natural and social sciences and so on. These are fundamental for competence development, especially for generic competence. Ignorance of cultural education in TVET often results in failing to meet the needs of social and economic development and can devolve TVET institutions towards training centres in nature. To be a TVET polytechnic, its major responsibility is to nurture competent future graduates for society with humanistic, spiritual and cultural qualities so as to be qualified community members with their own expected behaviour standards, personal thoughts and innovative ideas. That is why cultural education should be placed at the first

position of the 'three kinds of education'. And it answers the question of what kind of talents the polytechnics should cultivate.

Comprehensive education is the second part of the 'three kinds of education'. The reality in China is that the matching rate between studied specialties and field of employment of polytechnic graduates is low. The highest rate at the national level in 2011 was no more than 60 % and some were as low as 40 % (MyCOS 2011). Quite a number of first-line experts express that too narrow specializations are neither beneficial nor sustainable for the students. And for narrowly trained graduates, it is not easy for them to find promising employment with a positive perspective (Hu 2007; Cui 2009; Lai 2011; Shao 2013; Yang et al. 2013). In such a context, SZPT offers comprehensive education and has redesigned the curriculum structure as 'generic education, plus major, plus minor specialty', trying to give their students opportunities to study a minor specialty of 15 credits in addition to the generic (≈40 credits) and major education (≈65 credits) (1 credit =18 teaching hours + 10 self-study hours). The minor specialty is to give students a general introduction of a new specialty and to expand their horizons. Such a reform is to provide an answer to the question of what should be taught in the polytechnics to the students to make them fully competent.

The last part of the 'three kinds of education' is cooperative, which means that TVET institutions need to cooperate closely internally among schools and externally with industries for offering efficient and effective integrated vocational or professional education to their students. It is quite necessary as well. Internal cooperation provides more opportunities for the students to learn what they like and want, even cross-disciplines. And external cooperation creates more practical work placements for the students in real industrial contexts. This kind of education, in fact, gives an answer to the question of how polytechnics should operate for nurturing competent graduates for the society.

Shenzhen Polytechnic's philosophy of 'three kinds of education' in practice has elevated its own awareness of culture, understanding of education and willingness to innovate. The philosophy has been recognized, supported and accepted by many other polytechnics and has also been adopted by the Central Government. The 'three kinds of education' form a complete connotation of the philosophy for running the polytechnics in China today, to guarantee the integrated vocational competence which is needed by higher TVET students. And this can also be taken as one of Chinese interpretations of integrated CBE for higher TVET.

Practical Implementation of Integrated CBE in SZPT.

China's integrated CBE is more comprehensive in content than the CBE in some western countries but similar to Germany's competence-based vocational education relying on complex contexts (Kuang 2010). Germans explain that a learning field (see the chapter of Gessler in this volume about the development and meaning of learning fields in Germany) is a professional education unit based on professional tasks and can be taught as a module (Zhao 2010). Strategies for teaching and learning

of these tasks should be aligned with the characteristics of those tasks. As a pioneering polytechnic, SZPT has practised several of these reforms such as the following.

Vary strategies for cultivating competence necessary for graduates.

Special attention and efforts are given to generic competence in SZPT. Various cultural modules and cultural activities and programmes are designed for its students. Among them, some are dominant, e.g. lessons of humanistic quality, optional subjects of arts and module of science and technology. And some are of secondary order, such as extracurricular activities, psychological guidance, occupational guidance and volunteer activities. SZPT requires each specialty to include at least three core generic competence modules in their curricula while enhancing the teaching of foreign languages and assessing the physical education. It has also set six targets for the students, encouraging them to have beautiful handwriting, be able to write high-quality papers, speak fluent Mandarin, read several masterpiece books and enrich their common knowledge of humanities and skill acquisition. When the students are assembled for classes or practice in industrial centres (constructed on the campuses), they are required to follow industrial routines and regulations, such as wearing a uniform, clocking in and out, listening to morning instruction, following workshop rules and so on. In addition, regular cultural and academic presentations and lectures by renowned scholars and social persons are managed for the students. Associations of reading, academies of classical learning, mutual aid association, interest clubs and so on are organized. Based on the highly praised volunteer services for the 26 Universiade which was held in Shenzhen in 2011, SZPT has made a decision to construct the polytechnic as a volunteer institution. All of these have been taken for the construction of a very cultural campus and inspiring education environment for the students.

For carrying out integrated professional education, SZPT teachers have also tried many strategies according to the following three basic principles. Technical and vocational courses should reflect present production and up-to-date techniques and skills. Instruction of application courses should be composed of practice, case studies, problem discussions and experiencing process. Fine art design courses should be expressive, aesthetic and technique centred.

For a better integrated CBE environment for the students, SZPT also requires that each specialty should have its own committee for the specialty development and supervision. The members of the committees should come from associations, industries, government bodies and the polytechnic. In addition, it also requests each specialty to find proper companies, institutions and organizations in society to establish at least three practicing sites outside the campus, which can be linked to their on-campus workshops. Through these sites, the specialties collect up-to-date technological information, deepen their relationship with the industries and enhance the win-win cooperation in applied research and promoting the industries. In SZPT's own words, the polytechnic needs the market hand stretching into it.

Reform the process of curriculum development.

A well-developed curriculum is primary for caching up with the requirements of the labour market to guarantee the quality of graduates. For this kind of curricula, SZPT has opened its door for the public to give suggestions, formulate requirements and set criteria as a reaction to various research studies (Jiang 2009, 2011; Wu et al. 2004; Xu 2008) and to give the opportunity for supervision of specialty committees. In the practice of designing a curriculum, the polytechnic has also absorbed experiences and key elements together with the TVET educators in China from DACUM, DCCD, work process-based vocational quality analysis, professional task analysis for designing the learning contexts, learning field curriculum and course development (Jiang 2009, 2011; Tao 2006). They also apply the theoretical achievement of constructivism, cognitive analysis and multiple intelligence (Jiang 2011; Wen and Jia 2002; Yang and Jia 2011; Yu et al. 2000; Zhu 2003; Zhang 2002).

For the integrated CBE, SZPT curriculum designers give notice to the coherence of culture, knowledge and skills or, in the terms of this paper, of competence while developing their curricula. They try to get rid of traditional ways of thinking in arranging the theoretical contents. In the designing process, they first deconstruct the knowledge of academic systems into sections. Then they select those needed for the specific skills, techniques and competence. In their concept, theoretical knowledge in TVET curriculum design should be limited to the needs but not integrity because TVET students only need to know what or how but not why in their theoretical studies. So, on the fundamental work of deconstructing the theories and knowledge, they reconstruct the pieces of knowledge and match them with the corresponding techniques, skills and competence.

While selecting the content for integrated competence cultivation for a curriculum, designers search for learning fields to link vocational contents in chains. Usually a career needs about 15 professional tasks, which reflect sets of competence to do a real piece of work, including knowledge, practical skills, techniques, attitudes, actions and behaviours. The nature of the learning field is that it is not representation of academic disciplines, but a reflection of professional tasks within a career (Zhao 2010). The following comparison between SZPT's present module with the traditional one for Practice of Declaring International Logistics at Customs may help to understand the difference (see Table 20.2).

Of course, there are also other methods for curriculum development while the learning field and work process-based analysis take the major positions.

Renew teaching and learning administration.

In TVET teaching processes, integration of teaching and practice is of utmost importance. SZPT teachers have tried various strategies based on the experiences from other countries, aiming at crossing the boundaries between classrooms and working sites.

Educators know that they need to establish a flexible education system and a credit system to achieve the integrated CBE aims. Firstly, the two systems can provide conveniences to enterprises in managing the production site for teaching

Table 20.2 Content arrangement comparison for the module of practice of declaring international logistics at customs

Traditional module contents		SZPT's work process based learning field (a module)
Chapter 1. Customs clearance and customs management		Step 1. Classification of goods
Chapter 2. Customs clearance and governance of foreign trade		Step 2. Preparation of the documents for the declaring goods
Chapter 3. Classification of import and export goods		Step 3. Filling in customs declaration forms
Chapter 4. Taxes for import and export		Step 4. Hand in forms and documents
Chapter 5. Filling customs declaration forms		Step 5. Waiting for the inspection
Chapter 6. Procedure for customs declaration		Step 6. Paying taxes
Chapter 7. Laws and regulations for customs		Step 7. Customs clearance
		Step 8. Verification clearance

Source: Wen et al. 2013. *Become a Master Teacher in Higher TVET Institutions—SZPT Master Teachers' Understanding of Instruction*. Higher Education Press. Beijing

purposes and work placement for the students. This is difficult to carry out when the traditional school-year administration system needs to be followed. Secondly, they provide the possibilities for establishing courses based on learning fields and for linking teaching and learning with the working processes. They guarantee the development of students with integrated competence. Thus, the students may have more options of what they want to learn and satisfy their learning interests and requirements. Thirdly, the world is in an era of the learning society, and it has become an unavoidable choice for people to accept further education and life-long learning. The two systems can offer more space for TVET institutions to extend, widen and vary the TVET services to the society.

With an investment of several years of constructing higher TVET, SZPT has set up the framework of the two systems already by designing and putting forwards related regulations. Currently, students may fulfil their 3-year education in 5 years' time with 2 years of extension for personal reasons. While in the school, students' prior or related studying and high standard achievement can be recognized for a certain amount of credits, or these students can get an exemption for having to take a minor specialty. Examples of qualifying activities are studying for an advanced certificate (e.g. CCIE, *Huawei* certificates), self-studying examinations for degrees, public recognized innovations or winning medals in national or international competence competitions. SZPT has also constructed an entrepreneurship street for its students. Students may get a room along school's innovation street with no charge for a 1-year term to run their entrepreneurship programme after a severe assessment by publicly invited business experts. Students may choose 1 or 2 years extension of their schooling for the project or do it while studying. Their success in the project can contribute credits for their diploma. As required, students should sit in

school-organized presentations or speeches or polytechnic-organized cultural events to accumulate their social activity or culture learning credits. Certain volunteer service hours can also be transferred into credits.

In SZPT, computer rooms, labs and workshops are open according to students' needs and requirements. Comfortable environments for studying and necessary funding, logistics and facilities are guaranteed for students to carry out their own activities. Learning by doing is a widely accepted concept in the polytechnic. Based on this, SZPT also has a regulation that when more than five students have the same interest, they may apply to set up their own interest club with some funding from the school. It has resulted in over a hundred interest clubs on campuses. Some clubs even host national gold medal winners in competence competitions.

Improve teachers and group academic and vocational teachers together.

The quality of teachers, especially their own competence, their understanding of integrated CBE and the strategies of grouping academic and vocational teachers in teams, is quite important for the implementation of the integrated CBE.

For historical reasons, the majority of teachers in China polytechnics were educated in academic universities and have no industrial experience. Actually they are not competent to take responsibility for tutoring students in hard or professional competence-based education. As a huge developing country, China still has big gaps between the business sector and the education. The policies, regulations and mechanisms are still far from complete and systematic. Enterprises have difficulties in establishing long-term working relationships with schools. The way for cooperation between TVET institutions and industries is still simple. The real situation is that TVET institutions are still tightly controlled by 'plans' while industries are relying on 'markets'.

In such an environment, SZPT has established a regulation that teachers from academic universities who do not have sufficient social and industrial experience must spend a period of time 'practising in related enterprises' or obtaining a vocational qualification by taking examinations and skill assessments based on their self-learning and exercises. A title of 'dual-competent teacher' is given to those who have fulfilled such a task. Over 80 % of full-time teachers now in the SZPT have achieved this title, which offers one solution for improving teachers' vocational qualification and competence. In addition, SZPT opens its door to society, exploring proper professional teacher resources from various industrial fields, and is employing 1444 part-time teachers now. Those part-time teachers are grouped together with full-time teachers to form proper teams for complementary advantages and for specific groups of students. Furthermore, the polytechnic also asks its cooperative enterprises to nominate senior staff or engineers to give specific lectures or presentations to the teachers and students on campus. They bring in their front-line knowledge, experience and practically needed competence to the students. These strategies have been proven successful in solving the technical and vocational competence problems of the teachers.

20.5 Conclusions

CBE is a widely adopted education philosophy for promoting TVET development in the world currently. Yet it is practised differently in various countries. In the USA, it emphasizes personality-based competence, while in the UK it focuses on qualifications. Germany is transforming VET based on acknowledged and regulated jobs to VET based on vocational fields in complex contexts, and Japan changes its system from quality-based to job-based. The system in France is heavily knowledge-based and Australia integration-based (Kuang 2010). The TVET system in China has been predominantly knowledge-based, like the system in France (Liu 2003), but it has also been reforming to a system which is based on integrated competence, currently with three kinds of education in some pioneering polytechnics (Liu 2008, 2009; Liu et al. 2010, 2012; Zhu 2012; Li and Qing 2013; Li 2014 etc.). The new practices have provided answers as to what, how and where to offer higher TVET to their students so as to meet the needs of the present human resource requirements of the society, the economy and industries.

As an education institution for nurturing professional and vocational talents for the current society and economy, polytechnics should provide students with holistic education (Qian 1998; Meng 2002; Chen 2003; Lu 2006; Jiang 2008, 2009, 2011; Cui 2009; CNSAES and MyCOS 2012 etc.), which does not only cover the hard competencies but, even more importantly, the soft competencies as well (Fan 2010; Dai 2011; Liu 2007; Guan 2007; Li 2008a; Li 2008b; Song 2009; Xu 2009; Xiong and Zeng 2010; Ma et al. 2012; Peng et al. 2013; Zhu 2013; Liu 2015 etc.). They form the integrated professional or vocational competence needed by modern industries and society. That is to say, narrowly focused CBE is far from enough nowadays for preparing vocational talents for the future society.

For this integrated vocational competence and holistic education, China has kept being devoted to developing vocational or professional competence of students while setting aside quite an amount of time and effort for providing the students with cultural and contextual competence development opportunities for making them qualified talents and independent members of the civil society. In addition, strategy reforms in curriculum development, flexible administration systems, credit transfer systems and 'dual-competent' teachers provide the possibility for this.

Experts in China have been studying the experiences with TVET in various countries. Significant improvement has been achieved in the past two decades in constructing this system, but China still needs to learn a lot from the West and to make more efforts to improve integrated TVET with Chinese features to arrive at a more efficient and effective education system for its rapid overall development.

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Chapter 21
Competence-based Training in South Asia

Brajesh Panth and Rhona B. Caoli-Rodriguez

21.1 Introduction

The South Asian population is young and is expected to supply 40 % of the global labor force by 2030. Demand for middle skills particularly is highest in domestic and overseas labor markets. However, South Asia's education profile is behind most of the regions in the world. Given that the demographic dividend is a double-edged sword, which may prove a nightmare unless addressed urgently, and with rapid investments, it is crucial to recognize that both quantity and quality of skilling the large working-age population are equally important for South Asia to move forward to sustain high economic growth. This means that South Asia has to evolve its own unique model to skill, reskill, and upskill its very large working population to transform it into a globally competitive workforce, while meeting international standards.

Average school attainment in South Asia except Sri Lanka is around 6 years which is much lower than other regions such as Southeast Asia, Europe, and North America which have 10 years or more of average school attainment. Over half of the labor force in Bangladesh, Nepal, and India has either no education or only up to primary level education, and under 5 % have any kind of vocational training, although this is changing rapidly with the younger cohort getting more and more education. These countries also have over 80 % of the labor force in the informal sector. While population growth rates have slowed down in these countries, the population is still growing and will peak around 2050 before stabilizing. Against this backdrop, governments have recognized the urgency to invest in human development, but the challenge is how to do so rapidly by front-loading investments.

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The section below on the status of competence-based training in South Asia has benefited from inputs from Dr. Sunil Chadrasiri, higher education and Technical and Vocational Education and Training (TVET) expert in Sri Lanka; Mr. Ahasan Habib and Md. Mohiuzzaman, TVET experts in Bangladesh; and Mr. Devi Dahal, TVET expert in Nepal.

21.2 Emerging Vision in South Asia for Education and Training

Almost all countries in South Asia have recently developed and approved national policies on education and skills development. The emphasis on schooling is to have basic education of 8 years by combining primary (grades 1–5) and lower-secondary (grades 6–8) and secondary education of 4 years by integrating secondary (grades 9 and 10) with upper-secondary education (grades 11 and 12) in line with the international practice. For university education, the focus is on getting more students in science and technology-based higher education and to increase overall gross enrollment which is still less than half the global average of around 28 %. Given the low educational attainment of the population, the emphasis on skills development is also designed to address the skilling needs of those who have little or no education in addition to improving the quality and relevance of more formal skills training at certificate (post grade 8) and diploma (post grade 10 and grade 12) level. National skills development policies also recognize the need to promote public-private partnerships to enhance the relevance of skills development with much higher labor market outcomes.

National skills development policies are seeking a paradigm shift in skills development in a number of areas: (1) from a fragmented provision of skills development through over 20 ministries and departments to one coordinated institutional arrangement; (2) from multiple sources of scattered funding mechanism to one unified sustainable funding mechanism that promotes subsidies where necessary and cost recovery and cost sharing by different stakeholders where feasible to substantially increase funding to expand overall provision; (3) establishing a credible quality assurance system in partnership between the government's quality assurance body, private sector, and linkages with regional and international quality assurance systems to ensure mutual recognition; and (4) informing investments in skills development by developing a common monitoring system including regular tracer studies and skills gap analysis and moving toward standardization where it is feasible and necessary.

Major efforts are devoted to developing quality assurance to cover mainly course development, training of trainers, registration of training institutions, and assessment and certification. It is important that the quality and certification are recognized not only in the country but also in other countries that receive labor from South Asian countries. Course development is now being aligned with the National

Qualifications Framework (NQF) and National Occupational Standards in key sectors of the economy. There is also a major shift to competence-based training (CBT) which is either already happening or being prepared to support this transition. However, CBT is still at an initial stage in South Asia. Revisiting some concepts and practices related to CBT is useful to help explore how CBT can work in the context of South Asia. Although the literature for CBT and related topics abound, the following sections explore some of the basic concepts and developments related to CBT.

21.3 Quality Assurance in Skills Development

With globalization comes an increasing labor mobility and rising pressure for competitiveness and productivity. At varying degree of success, countries struggle to keep up with the standards dictated by both domestic and global labor markets. One of the primary steps to demonstrate that a country's labor force is up to standard is to establish and implement a quality assurance system for education and training. Quality assurance, in relation to training and educational services, refers to "planned and systematic processes that provide confidence in educational services provided by training providers under the remit of relevant authorities or bodies. It is a set of activities established by these relevant authorities or bodies to ensure that educational services satisfy customer requirements in a systematic, reliable fashion" (Bateman et al. 2012). The system is not only aimed at building confidence from the end users but also assures trainees that the quality of the qualifications they gain are commensurate to their investment.

A typical quality assurance system in TVET covers core areas such as accreditation of qualifications; registration, recognition, and accreditation of training providers, including their trainers; monitoring of provider processes and outcomes; assessment and certification; and system-wide evaluation of TVET, including evaluation by external agencies (Bateman and Coles 2013). The Australia Quality Training Framework and Germany's Quality Assurance and Quality Improvement of persons, products, and processes are examples of TVET quality assurance. Approaches to TVET quality assurance greatly vary depending on the context of governance and TVET systems which influence the purposes and the mechanisms used for quality assurance. TVET quality assurance in Germany, New Zealand, Singapore, and the UK are located within the structural and governance arrangements for education and training. On the other hand, the quality of Canada's TVET programs is primarily the responsibility of training institutions, but must be compliant with the territorial governments' established legislative and policy frameworks. The country's history and labor market contexts, as well as the broader political system and economic policies, also influence TVET markets and regulatory systems.

Regional quality assurance frameworks have also emerged recently, such as the European Quality Assurance Reference Framework for vocational education and

training (VET); Pacific Register of Qualifications and Standards: Quality Assurance Standards; and East Asia Summit VET Quality Assurance Framework. They basically aim to develop mutual understanding among countries in the region and also to promote mutual recognition, among others. The Association of Southeast Asian Nations (ASEAN) has the regional quality assurance framework for higher education (ASEAN Quality Assurance Framework for Higher Education) and has initiated the formulation of the ASEAN Qualifications Reference Framework that covers education and training, as well as lifelong learning. It is expected to serve as a common reference and translation instrument for comparisons of qualifications across ASEAN member states and is envisioned to link participating nations' qualification systems or frameworks and become a mechanism for recognition of qualifications with other regional and international qualification systems (Bateman et al. 2009).

An NQF serves as an instrument for the development and classification of qualifications (e.g., at national- or sectoral-level qualifications) according to a set of criteria (e.g., using descriptors) applicable to specific levels of learning outcomes. It supports lifelong learning by aiding access, participation, and progression, and recognition (credit transfer, recognition of prior learning (RPL), including those acquired through non-formal and informal learning), strengthen the link and improve the communication between education and training and the labor market, among others. It also provides a reference point for quality assurance (Bateman and Coles 2013). In formulating a framework for designing and describing programs based on competence and levels, the NQF serves as an important tool for transparency and confidence building among stakeholders. As such, its role is crucial in quality assurance procedures (Bienefeld et al. 2008).

Qualification frameworks are distinct but related to qualification systems. Qualification frameworks widely include all qualifications, and their combinations, in the country and the institutions, processes, and mechanisms which support the provision of such qualifications. However, a national qualifications framework is not just a matrix that shows how various qualifications are related. It illustrates how qualifications are gained. Since qualifications consist of a set of nationally agreed standards/criteria that are classified at various levels, they can be gained by obtaining competencies (or expected learning outcomes) specified by such standards regardless of the time, place, or instructions used by the education or training institutions (OECD 2005). This is the foundation for a CBT approach.

21.4 Notes on Competence-based Training

As described in Chap. 1, there have been persistent arguments for and against the CBT approach. Even the definition of competence and competency is constantly subject to debates alongside rapid technological developments and changing domestic and international labor market situations. Although the general principle of competence may be widely accepted, there are relentless issues in translating it into a form that accounts for the knowledge, skills, and attitudes required in the

performance of a particular job within a certain context, e.g., within South Asia countries (Guthrie 2009; Kodiappan 2011).

Mulder et al. (2007) provide a holistic view of CBT and the continuous evolution of competence within the context of lifelong learning and widely varied practices in TVET across countries that have adopted CBT. Competence is defined as the "… capability to perform and to use knowledge, skills and attitudes that are integrated in the professional repertoire of the individual. Measures regarding the development of vocational education and training should be based on continuous competence development processes involving pupils, students and graduates from the perspective of lifelong learning" (Mulder et al. 2007:82).

CBT has become a trend, also in South Asia. Studies and discourses from all regions abound. It is considered as the approach with most potential in improving education and training in this era of rapid technological development and internationalization and in preparing the workforce for the global labor market. CBT programs usually engage students' learning at their own pace and using their own learning methods to meet their learning objectives and achieve learning outcomes against the standards set rather than against performance of other students in a given group. The focus is on what the individual can do after the training and not on processes or methods employed during the training. Learning outcomes, in turn, are concerned with industry-specific standards, thereby zeroing in on clear knowledge required by the job/industry.

CBT has evolved into an innovative approach of education and training that can serve as a practical framework for countries in producing a competitive, world-class, multi-skilled, and adaptable workforce. To optimize the potential of CBT competencies must be dovetailed with the industry needs in both local and international labor markets. As such, this approach has most potential in minimizing skills gaps because the standards and requirements by which competencies are specified emanate from the end users. It should be noted that industry requirements are also continuously changing due to development in technology, labor mobility, and demographic shifts, among other factors. CBT can easily adjust through constant updating and upgrading of contents and methods. Another advantage of the methodical and holistic feature of a CBT approach is that a CBT-based framework can better facilitate rapid retraining programs in cases of economic downturns when some industries weaken and retrenchments happen. Workers can undergo rapid retaining focusing on the specific skills needed to shift toward more enduring enterprises.

Among the good practices in adopting a CBT approach is linking it to a national qualification framework that includes TVET to articulate the levels and classifications of qualifications based on the set of agreed criteria or descriptors. For example, the Australian Qualifications Framework (AQF) is a coherent framework for qualifications from senior secondary to doctoral degrees. It contains six TVET qualifications for which training packages specify the combination of competence standards required to achieve a particular qualification. Learners who complete only some standards for a qualification are awarded a statement of attainment. They receive qualifications when they are evaluated as competent in all standards within

that qualification (GIZ 2011). The Australian model is very much the approach adopted by the Philippines. The Philippine TVET Qualifications Framework is composed of qualifications made up of units of competence which in turn are the basis for training modules. Awarding of achievement may be by competence or by qualification as well.

In cases of multiple agencies involved in the provision and management of TVET, coordination and coherence among them are essential in implementing CBT. In addition, a national qualifications framework supported by a reliable quality assurance mechanism can mitigate possible conflicts in terms of consistency in program outcomes and quality. In a study by Bowen-Clewely et al. (2014), countries with a single national agency responsible for TVET quality assurance, however, are found to have better TVET quality compared to those with multiple agencies and more complex systems (countries included in the study are Australia, Bahrain, Malaysia, New Zealand, Singapore, Sri Lanka, and the Philippines).

Formulating an effective competence framework requires the adequate and meaningful input of industries and employers. Industry involvement is important both during the initial formulation of the competence frameworks and during updating or upgrading of these competencies as well as even during actual training and evaluation in the case of enterprise-based training. Hence, strong partnership and collaboration with industry and employers is imperative for the success of the CBT approach to education and training.

A purposive social marketing campaign must accompany the implementation of competence-based training. Not only does it reinforce transparency, it also nurtures trust among key stakeholders. Hence, competencies must be carefully identified and clearly described for public knowledge. All these considered, Hellwig (2006) and Guthrie (2009) state that for the implementation of CBT to be successful, it still entails facilities and instructional equipment, as well as suitable learning materials.

Credible assessment is a critical component of CBT. If the focus is on performance of distinct competencies, there is a danger that assessment may be "reduced to checklist approach." When a person is declared "competent" but performs poorly in the workplace, the reputation of the institution, the teacher, and the assessor may be compromised. On the other hand, the tendency to over-assess may also happen due to the pressure to ensure that the student is competent, leading to inefficiency, especially with a large number of candidates to be assessed. This risk can be significantly reduced by ensuring that CBT assessors are well prepared and given necessary technical support (Hellwig 2006). Mulder et al. (2007) have noted that listing specific and clear competencies does not ensure a sound and effective design for learning. The role of training providers is crucial in translating such competencies into teaching, learning, and assessment.

21.5 Status of Competence-based Training in South Asia and Its Implications

As noted at the outset of this chapter, South Asia is estimated to supply almost 40 % of the global demand for labor in the coming decades because of the demographic dividend of its young population (McKinsey Global Institute 2012). However, this window is limited to around three decades within which time the region must strategically seize the chance to turn its young population into a competitive and productive workforce. It is critical to develop a quality-assured and globally recognized skills training system that can help increase exports, remittances, industry competitiveness, and eventually wages of the population and economic growth of the countries to move up the value chain. Practice-oriented CBT approach is critical to help achieve this.

South Asia has the potential to benefit from CBT, but this will require countries in the region to adopt and implement enabling policies, maintain synergy among key players (e.g., governments, private sectors including industries and employers), and ensure standards. In doing this, South Asia can benefit tremendously by positioning itself to address some key challenges in skills development such as rapid technological changes, large scale high quality training of trainers, adapting to its rapidly changing labor market needs, increasing labor mobility, and the urgent need to recognize prior learning to fill in the gaps largely caused by low educational attainment and training of the workforce.

At present, countries in South Asia have varied experience in CBT. Sri Lanka is the most advanced in terms of having established its National Vocational Qualifications Framework (NVQF) in 2005, although it is still struggling to fully operationalize it.

21.6 Case of Sri Lanka

The National Vocational Qualification (NVQ) in Sri Lanka was initially implemented at lower levels to target craft-level occupations and qualifications. Not many people were interested in NVQs at that time. However, following the establishment of Colleges of Technology (CoTs), one in each of the nine provinces to offer NVQ levels 5 and 6 diplomas and the establishment of the University of Vocational Technology (UNIVOTEC) to offer degrees at NVQ level 7, more attention was given to the NVQ system by stakeholders. The NVQ has now emerged as an issue, particularly with its recognition as a standard qualification for government jobs and the alignment of salary scales with NVQ levels.

The NVQF of Sri Lanka (NVQFSL) was established in August 2004 through an executive order issued by the then Minister of Skills Development, Vocational and Technical Education. This executive order had been issued in accordance with the relevant section of the 1990 Tertiary and Vocational Education Act. According to the circular issued in 2005 by the Secretary of the Ministry of Skills Development,

Vocational and Technical Education, the full implementation of the NVQF from level 1 to level 4 came into effect on 1 January 2006. Consequently, the first group of NVQ holders obtained their certificates in February 2007.

Subsequently, the TVET sector of Sri Lanka underwent major reforms, and the NVQF became central to these reforms. Under these reforms, National Competency Standards (NCS), CBT using competence-based curricula, Competence-Based Assessments (CBA), and RPL were introduced. Registration of training providers, course accreditation, quality assurance procedures, and policies were strengthened. By June 2013, a total of 1,119 TVET providers had been registered with the Technical and Vocational Education Council (TVEC) to deliver 5,950 training courses. Of them, 1,388 or 23 % were accredited according to the NVQ system.

When introducing the NVQ, no major formal research had been done to study the qualifications that existed at that time. The number of levels was not based on rigorous analysis of the qualifications and the systems that prevailed prior to the establishment of the NVQF. As a result, this led to disparities between the new NVQs and the well-established qualifications that existed at the time of introducing the new NVQs. Level descriptors of the seven levels introduced in the new NVQs were adapted from the New Zealand National Qualifications Framework. Recent developments and reforms in the TVET sector of Sri Lanka have evolved from the NVQF introduced in 2005.

NVQFSL is the main component of the government's initiative of unifying the provision of TVET in Sri Lanka. It is based on national competence standards in consultation with the industry. National competence standards specify technical and employability competencies required by the practitioners of different occupations at different levels. NVQSL awards qualifications at seven different levels (Table 21.1). Qualifications at levels 1–4 are awarded by public, private, and NGO training providers. NVQ levels 5 and 6 are awarded by the nine CoTs that were established in the nine provinces of Sri Lanka. These CoTs are functioning under the Department of Technical Education and Training. Level 7 qualifications are awarded by the UNIVOTEC.

Table 21.1 Seven Levels of National Vocational Qualifications in Sri Lanka

Level no.	Qualification	Generalized description
Level 1	National Certificate	Level 1 recognizes the acquisition of entry-level competencies
Level 2	National Certificate	Levels 2, 3, and 4 recognize increasing levels of competencies Level 4 qualification provides for full craftsmanship/ workmanship
Level 3		
Level 4		
Level 5	National Diploma	Levels 5 and 6 recognize the increasing levels of competencies of technicians including supervision and process management
Level 6		
Level 7	Bachelor's degree	Level 7 recognizes the vocational/technological competencies at the bachelor's level

Source: National Vocational Qualifications Framework of Sri Lanka (Operations Manual, October 2009), Technical and Vocational Education Council (TVEC), Ministry of Youth Affairs and Skills Development, Government of Sri Lanka. Colombo

Table 21.2 NVQ certificate recipients by training provider (first half of 2011 – first half of 2013)

Institute	2011–2013 (first half)	%
National Youth Services Council (NYSC)	1,192	3.4
Department of Technical Education and Training (DTET)	3,184	9.3
Vocational Training Authority (VTA)	13,019	37.6
National Apprenticeship and Industrial Training Authority (NAITA)	8,784	25.4
Private and nongovernmental sectors	8,358	24.3
Total	34,537	100.0

Source: Labour Market Information Bulletin 2013. Technical and Vocational Education Council (TVEC), Ministry of Youth Affairs and Skills Development, Government of Sri Lanka. Colombo

Table 21.3 NVQ certificates issued by occupation/sector and training provider in first half of 2013

Institute	Members	%
Department of Technical Education and Training (DTET)	550	6.4
National Apprenticeship and Industrial Training Authority – CBT	512	6.1
RPL	1,666	19.5
Vocational Training Authority (VTA)	2,246	26.3
National Youth Services Council (NYSC)	564	6.6
Private and nongovernmental sectors	2,991	35.1
Total	8,529	100

Source: Labour Market Information Bulletin 2013. Technical and Vocational Education Council (TVEC), Ministry of Youth Affairs and Skills Development, Government of Sri Lanka. Colombo

The curricula for courses at NVQ levels 1–4 comprise three documents, curriculum outline, trainer's guide, and learner's guides. These curricula use the narrow definition of competency. The curricula for these levels are task-based, whereas in the curricula for NVQ level 5 and above, the broader definition of competence is used. Curricula are outcome-based. In NVQFSL the curricula are also validated by the National Industrial Training Advisory Committee (NITAC) and are endorsed by TVEC. Curricula developed as such are then made available to public, private, and nongovernmental training centers. The assessment resources are also validated through the NITACs. Validated assessment resources are given to the competence assessors to conduct CBA.

Training providers conduct accredited training programs and award NVQs. NVQs through the RPL are awarded only up to NVQ level 4 by National Apprenticeship and Industrial Training Authority (NAITA) and the Vocational Training Authority (VTA). Table 21.2 and Table 21.3 summarize the current status of NVQ awards by major service providers. In terms of industry sub-sectors, it covers a wide cross section of industry groups and nongovernment sector participation

which was around 24 % (see Table 21.2). In terms of gender breakdown, about 63 % of NVQ recipients in the first half of 2013 were males.

The introduction of the NVQ system and the Sri Lanka Qualification (SLQ) system provide alternative paths to become a graduate. It has also helped education and skills development sectors to introduce an integrated skills development system for Sri Lanka. This has led to significant improvements in the skills development sector particularly in RPL and CBT.

21.6.1 Challenges of NVQ Implementation in Sri Lanka

The key challenges faced by the NVQ system in Sri Lanka are related to the following three broad areas – (1) issues related to definitions used for "qualifications" in the NVQ, (2) inconsistencies in competence standards, and (3) inappropriate titles of many qualifications:

1. *Definition of qualifications*. It will be useful to review the definitions used by other countries and make changes as appropriate to ensure consistency across the framework. Currently, there are a large number of narrower qualifications at lower NVQ levels.
2. *Inconsistencies in competence standards*. There is also recognition of the need to review the guidelines given in the NVQF Operations Manuals 2005 and 2009 to decide on the level of a qualification as these are noted to be ambiguous. The review can help TVEC to maintain a clear and an unambiguous policy and provide clear guidelines for qualification packaging to ensure consistency across occupations. Experts note that availability of employment opportunities for particular combinations of units should not be the only criteria for deciding on qualifications. This will help to avoid very narrow qualifications consisting of one or two units which inhibit the holder's mobility.
3. *Inappropriateness of titles*. Some experts also feel that the titles of many qualifications should also be reviewed to reflect true competencies of certificate holders. They emphasize the need to accurately describe the scope of the learning areas covered in the qualification standards. This requires some training for career and technical teachers. Many of these teachers enter the profession after having worked several years in the occupations they teach. These teachers must take courses in pedagogy to acquire a temporary or emergency certificate to allow them to teach. They must take additional courses to implement and further improve the NVQ system.

21.6.2 Status of Competence-based Training in Sri Lanka

Competence standards are industry-determined specifications of performance that set out the skills, knowledge, and attitudes required to operate effectively in a specific industry or profession. These standards are an endorsed component of a

training package. Competence units are made up of elements of competency jointly with performance criteria, a range of variables, and an evidence guide. The units of competence standards are individually assigned to a level, and vocational qualifications are also assigned levels.

In order to obtain NVQs, candidates must face a CBA, conducted by specially trained assessors. During the CBA, candidates are assessed with respect to all units of competencies that form the qualification. When candidates are found to be competent in all units of competencies of the concerned qualification, he/she is awarded that qualification. If candidates are found to be competent only in a few units only, a Record of Achievement of competence is given with respect to those units of competencies in which candidates were found competent.

Currently this system is well established and integrated with the NVQ-based qualification framework. In operational terms, RPL assessments are being conducted by the NAITA and VTA, while CBT standards are set by the NAITA. The curriculum is developed by the UNIVOTEC, while CBT assessments and issuing certificates are carried out by the TVEC. The training component is performed by all service providers including government, private, and nongovernmental organizations. Private sector service providers (training institutes) are involved in providing training. For overall coordination purposes, there is a steering committee which meets once a month to discuss issues relating to NVQ, CBT, and CBA. It comprises all service providers, administrators, and policy makers.

Several attempts have been made to enhance the capacity to deepen the use of CBT in skills development in terms of developing National Occupational Standards, mapping courses to provide credits for modules that lead to certain occupational standards and by NQF level. As mentioned above, there is an established institutional mechanism to implement the NVQ system including standard setting for CBT. However, no formal arrangement has been made to train teachers, assessors, and managers to facilitate this process. Capacity building of this group of individuals needs to be addressed in order to yield better results from the NVQ system.

In spite of these efforts, there are some gaps in the existing CBT system, such as the absence of clear guidance on competence standards and the inadequate emphasis on abilities of the practitioner regarding knowledge competencies. The following are some of the other issues which require immediate attention of policy makers and regulators to further enhance potential benefits of the NVQ system:

1. Clear guidelines should be given to the developers of competence standards on identification of units of competencies.
2. Units of competencies of the National Competence Standards should reflect the abilities that should be possessed by the practitioners and not the different products that they are capable of producing.
3. Knowledge that should be possessed by the practitioners are not reflected in almost all National Competence Standards. Knowledge specifications competencies are not given due recognition and are hidden in the underpinning knowledge component of competencies. Knowledge specifications should be brought into the National Competence Standards.

Sri Lanka can be an exemplary South Asian country to learn good practices from on CBT as it is evolving well. However, Australia, Germany, New Zealand, the Philippines, and the UK also have mature competence-based education systems which can provide lessons on effective implementation of CBT.

21.7 Case of India

With the approval of the National Policy on Skill Development in 2009, India embarked on an ambitious target of skilling and/or upskilling 500 million people by 2022. It was a major recognition by the government of the urgent need to convert its large young population into a productive labor force that can compete in the domestic and global labor market in order to move up the value chain. A major challenge for India is how to prepare its large working population, which will continue to grow during the next few decades, into a productive labor force within a short period of time. A monumental task is therefore to mobilize the public and private sector to work together through a massive coordination, consolidation, and implementation effort.

Three critical elements are evolving rapidly as a policy response from the government to operationalize its agenda of the skilling of the new entrants and the upskilling of the existing workers. First, the target has galvanized many initiatives from both the public and private sectors. The establishment of the National Skill Development Corporation (NSDC) is pivotal in engaging some of the best private sector training providers to train 150 million people by 2022. Second, the National Skill Development Agency (NSDA) established in 2013 is tasked to help operationalize a National Skill Qualification Framework (NSQF) to ensure a quality-assured skills development system, coordinate the targets of skilling across public and private institutions, and strengthen the state skills development mission in each state to coordinate training programs to meet the targets. Third, the establishment of the Ministry of Skill Development and Entrepreneurship is significant to further consolidate, coordinate, and enhance the skills development agenda. It has also issued a new National Skill Development Policy 2015.

The NSQF organizes qualifications according to levels of knowledge, skills, and attitudes. It is a nationally integrated education and competence-based skills framework that provides multiple pathways and multiple entry and exit points at horizontal and vertical levels. It has 10 levels, starting from level 1 and going up to level 10. The framework allows people to move from work to training (formal and informal) or from training to work and has a provision for recognition of prior learning, so people may earn credits for what they have learned in training, education, and work. It is mandatory for all training programs to be NSQF compliant within 5 years of the notification.

NSDC has approved over 30 Sector Skills Councils (SSCs), and several have been operational. The SSCs are establishing National Occupational Standards for each of these sectors. The SSCs have also developed Qualifications Packs. NSDC is now focusing on supporting training of trainer programs through partnerships with

international partners, as this component will be a key link in ensuring qualitative expansion of training programs. Another area that is evolving rapidly is assessment and certification. Assessment agencies are being empaneled to provide independent assessment of trainees to enhance accountability of training providers. Credible certification is emerging through partnerships between training providers, employers, and government agencies such as the National Council for Vocational Training (NCVT) and State Council for Vocational Training (SCVT). These initiatives are facilitating the move toward CBT, as NSDC's initiatives along with NSDA's leadership in facilitating the implementation of NSQF will lead to gradual expansion of CBT across different sectors including ensuring convergence. However, four areas are crucial in India for CBT to take root:

First, India cannot wait too long to establish a perfect system given its urgency to train a large number of people either entering the labor market every year or to upskill the labor force. Therefore, it is important to implement short-term courses on a large scale, but these have to be modularized within a group of skills levels to be attained, and their credits have to be recognized so that people receiving training can move from training to work, from general education to training and to work, from work to general education and to training, and so on. Credit transfer mechanisms are crucial to provide different entry and exit points for people to continue to build their skills base. The provision of short-term courses may be a predominant mechanism for skilling new entrants and upskilling existing workers in the next 10 years. Concurrently, it is expected that school attainment will continue to rise along with the expansion of longer-term market-responsive training programs that cater middle skills in the domestic and global labor markets.

Second, partnerships of different kinds are vital to expand capacity at different fronts. These include expanding training through private training providers, enterprise-based training with the active participation of large enterprises in partnership with training institutions, public training providers in partnership with private training providers and enterprises to enhance quality and relevance, and in partnership with global training institutions and/or enterprises that bring clear value addition (e.g., mining, retail, manufacturing, etc.). These multiple partnerships require incentives both at the demand and supply side so that existing and future labor market needs are addressed systematically.

Third, massive technical and capacity support is needed to scale up training of trainers and the quality of training in line with NSQF requirements. Such large-scale support needs to be linked with the NSQF implementation schedule so that states and training institutions are able to avail of technical services through a simple process and can sponsor credible programs that are assessed to be of good quality. There is therefore a need to monitor and identify good practices and programs that can be expanded through sponsored programs with stakes from key players.

Fourth, to be able to get the scale that India is set to achieve, it is critical to tie up skills training with the formal schooling system. This process has already started,

but this will require much more effort to bridge the link between high school-level vocational education and training and the private sector and employer groups. A major advantage of this approach is that it will allow a natural application of CBT, as general schooling is also competence-based. This synergy will help to broaden the profile of learners by addressing cognitive and noncognitive skills that are critical to enhance employability of school graduates. Kerala's initiative to introduce Additional Skill Acquisition Program in high school and undergraduate programs is a good example of an effort to complement occupational skills with soft skills to enhance the employability of graduates.

21.8 Case of Bangladesh

The National Skills Development Policy (NSDP) was approved by the government in January 2012 that includes a new qualification framework "National Technical and Vocational Qualifications Framework" (NTVQF). The NTVQF was developed with support from the International Labour Organization (ILO)-TVET Reform Project in 2010 (ADB 2015a). Bangladesh Technical Education Board (BTEB), the apex body for quality assurance, is responsible for its management and implementation. Some CBT courses have been developed and piloted based on the NTVQF framework. The piloting of CBT courses started in 2010 in eight public and private training institutions under the ILO-TVET Reform Project. BTEB has so far certified 140 trainees for NTVQF level 1. The challenges faced in effective implementation are (1) while CBT courses are aligned with NTVQF, conventional long courses are also implemented in parallel. The teachers and staff are more interested in running conventional courses; (2) CBT courses are implemented in addition to the conventional long courses (secondary school certificate vocational), but these institutions focus more on conventional courses; (3) although piloting of CBT programs was initiated with the financial and technical assistance of TVET reform project, it is not clear who will continue funding after the funding runs out from the project, nor is there a government order to continue the CBT courses, thereby creating uncertainty about the continuity of such courses; (4) since the piloting of CBT was limited to NTVQF level 1 (basic worker) in most cases, the skills achieved by the certified trainees did not lead to job offers from employers in the semi-skilled and skilled jobs; (5) BTEB certified teachers and assessors are not available to implement CBT courses in a much larger scale; (6) the lack of capacity of BTEB to support and oversee the continuation of CBT courses may delay the adaptation process; (7) there is need for a rollout plan from BTEB, NSDC Secretariat, and other implementing agencies to continue implementing CBT programs; (vii) there is no evidence yet of wage premium for CBT certified workers in the industry, and (8) there is a need for a strong follow-up mechanism from BTEB and NSDC Secretariat to promote CBT.

Several ongoing projects or new projects plan to support CBT training, but this will require clarity in policy direction and implementation arrangements to address the initial challenges encountered during the piloting of CBT courses. In addition,

there is also an urgent need to ensure effective coordination to harmonize initiatives from different projects to support the rollout of CBT courses in a systematic way (ADB 2015a). This will require simplifying the procedures, incentivizing the system to implement CBT courses, developing and improving guidelines to implement CBT courses, strengthening BTEB to provide technical support to training institutions to implement CBT courses, and seeking buy-ins from major training providers to implement CBT courses within a stipulated time to ensure compliance.

A comprehensive plan for enhancing capacity for application of CBT in skills development is yet to evolve. The major elements for CBT implementation are (1) certified trainers, (2) institutions to be upgraded to become certified RTOs, (3) certified assessors, (4) capacity of BTEB to monitor and effectively manage implementation, (5) occupational standards aligned with NTVQF with endorsement of employers, and (6) awareness of the industrial sectors regarding implication of NTVQF certified skilled workers.

Currently, the preparation of different elements is being done through different projects. Therefore, it is now critical to develop concerted plans within an agreed framework to sustain and complete the rollout of CBT courses. Up to now, 141 standards in 51 occupations at different levels have been developed with support from TVET reform project and Skills Development Project (SDP). However, these are yet to be implemented fully. Also, the trainers trained under these two projects focused mainly on pedagogical skills, but more needs to be done on the technical skills. A total of 75 trainers trained under the two projects have been certified by BTEB. Another crucial element is identification of industry assessors, training, and certification by BTEB. Up to now, 200 assessors have been certified. UCEP is providing training for the assessors, but much more needs to be done to train and certify the assessors required for managing performance assessment of trainees. There is consensus that the capacity of BTEB has to be enhanced substantially to manage the scaling up and institutionalization of CBT implementation.

The major constraints in the implementation of CBT programs leading to NTVQF are inadequate infrastructure of the institutions like equipment, trained teachers, and assessors, and lack of clarity in respect of implementation within specified time frame and other issues as mentioned above. About 32 training institutions have been registered as RTO to implement different CBT courses. The implementation of CBT programs will not get momentum until the present conventional courses are gradually replaced, and the industry sectors give more weight on the CBT certified workforce. Other countries in South Asia face similar constraints. In order to achieve results, administrative reforms and ownership by public and private sectors are essential in respect of implementation of CBT courses leading to NTVQ Framework.

Thus, CBT implementation is still at an initial stage in Bangladesh. There is also a need to develop a system of providing credits for modules that can lead to NTVQF levels. There is plan of capacity building of BTEB and NSDC Secretariat and training of trainers and assessors for about 1,620 staff and management training of 150 principals and key administrators under the Skills for Employment Investment Pro (SEIP) initiative.

21.9 Case of Nepal

National Qualifications Framework (NQF) as such for the wider use in its real spirit does not exist yet in Nepal. However, the National TVET Policy 2012 clearly spells out the priority to develop and implement a NQF for Nepal (ADB 2015b). However, in its narrower application in Nepal, there are already four levels of skills certification through the National Skills Testing and Certification System. But it is limited to technical and vocational skills acquired either through informal or formal training. This system is also accessible for those workers who desire to be tested and certified on their skills and competence in a number of occupations. So far, the National Skills Testing Board has approved skills standards of over 270 occupations in Nepal. There is growing recognition of the importance of a NQF. In order to realize the policy stipulation under the National TVET Policy 2012, a separate project is in the pipeline to fully concentrate on the development and implementation of a National Vocational Qualifications System (NVQS) in Nepal. The project is started in 2015.

Development and implementation of NVQS are highly technical and time-consuming. It has to be fully synchronized with the existing education and training system in Nepal. Such a system cannot stand alone and must be integrated with the overall structure of education, testing, and certification that exist in the country. The level of expertise required to develop and implement NVQS is also a challenge in Nepal due to very limited human resources available to work on this. To overcome these challenges, it will be important to consider alternatives to support the NVQS. One such option is to apply a partnership-build-train-operate-transfer (PBTOT) scheme with a time horizon of 7–10 years to fully transition to the NVQS. This means, it will be critical to implement a well-designed project with adequate technical expertise outsourced to build the system in partnership with the concerned national agency (in this case, the Council for Technical Education and Vocational Training (CTEVT)), train the local staff, implement the system, and transfer the ownership with the tested tools and instruments to the government.

Nepal commenced CBT, at least curriculum development and implementation in selected technical schools like Balaju School of Engineering and Technology, in 1990. CTEVT is responsible, as entrusted by TVET Act 1989, for developing and implementing CBT. So far CTEVT has approved over 110 courses which were developed using a CBT approach. The development of such courses is done through participation of the private sector, especially expertise from industries for particular occupations. However, full involvement of the private sector throughout the development and implementation of such courses is not happening well. CTEVT is continuously striving to make it wide and to expand the system in different sectors. CTEVT's strategic plan with a vision for 2020 outlines a number of approaches for overall quality development of Skills Development (TVET system) in Nepal.

The Training Institute for Technical Instruction (TITI) under CTEVT operating as a semiautonomous institute is responsible for training of instructors (teachers), curriculum developers who are capable of developing CBT curricula, assessors, and

training institution managers in the country. TITI has also evolved as a regional center of excellence and is rendering its services to international clients for the last 12 years. Regional centers are being envisaged to expand and sustain TITI services as required in the future.

21.10 Conclusions

South Asia is experiencing a demographic growth and has the potential to supply almost half of the world's labor requirement with a skilled and competent workforce. South Asian governments have recognized the need to invest in innovative education and training approaches to harness the full potential of its human resources to sustain economic development. A key persistent issue on productivity and competitiveness confronting education and training systems for so long is the job-skills gap. The preparation and training of the workforce must be responsive to the competences demanded by industry, for both local and international employment. Now, South Asian governments must act quickly and strategically as the window of demographic dividend is limited. Missing this opportunity risks further increasing underemployment and unemployment, and the region will be unable to optimize the prospects of the international labor market.

As a training approach with most potential to minimize, if not eliminate, the gap between skills development and industry requirements, producing multi-skilled and adaptable workforce, CBT has great potentials for South Asia's labor force. Successful implementation of CBT requires basic elements such as national qualifications and quality assurance frameworks, and strong partnerships with industry must be in place. In this direction, South Asian countries have adopted national skills development policies that seek to reform the skills development system in the areas including governance and institutional arrangements, financing, quality assurance, and monitoring and evaluation. Major works and collaborations have been devoted to quality assurance and increased access.

Diverse patterns of progress toward implementation of CBT among South Asian countries can be observed. Sri Lanka has made good progress and is in a better situation given its more developed education system and early implementation of NVQF and CBT. However, the larger buy-in from the private sector is now crucial to link training with better employability and wages. Bangladesh has just developed its qualifications system and will need a further push to implement it. Nepal has already initiated the groundwork for improving its qualifications framework and is poised to devote substantial investments to make it happen. India, on the other hand, has started implementation of its National Skills Qualifications Framework and strategies to strengthen collaboration with the private sector in order to respond to large demand for training. The Indian Government recognizes the urgency to focus on quantity and quality to scale up skills training to meet emerging demand. This will require taking a fast track approach through a highly integrated approach and in partnerships with domestic and international institutions to ensure credible

expansion. Modularization with credit transfer, multiple pathways to allow mobility both horizontally and vertically, and large-scale public-private partnerships to fast track assessment and certification by anchoring on sector skills councils will be critical to sustain credible expansion.

CBT is the subject of much debate as it continues to evolve as an approach to education and training. It is argued that while specific competencies tend to be over-specified, the CBT approach can be holistic and adoptable to contexts and fits well with lifelong learning. The formulation and implementation of its enabling elements such as national qualifications and quality assurance frameworks have conditions and challenges. South Asian countries need to work harder on major issues such as multiple agencies involved in skills development, functioning credible quality assurance, and meaningful partnership with industry. There are ample lessons from countries like Australia, Germany, New Zealand, and the UK for countries in South Asia pursuing CBT more recently (Bangladesh, India, and Nepal). Experiences from the Philippines and Sri Lanka can also serve to guide CBT implementation.

Effective implementation of CBT in South Asian countries should be possible with the intensive support of the following:

1. For each industry, approved occupational standards should be developed and approved through a national body supported by key stakeholders.
2. Curricula developed with full participation of industry experts and facilitated by qualified, trained, and certified curriculum developers.
3. Fully trained instructors with sufficient industry experience in each occupation who can implement CBT.
4. Training providers with full sets of equipment, tools, and training materials required for the training (sufficient for each trainee) for enough practice in labs/workshops.
5. Assessment tools and instruments developed in line with each skill/competence from the curricula.
6. Quality training manual for guiding trainees on what and how to learn and what and how to be assessed in what conditions.
7. Physical learning environment of all training providers that address a safe and healthy work environment (international standards and practices should be followed on this and adapted in the local context).
8. Managers in the training institutions should also be fully oriented on the CBT approach.

These are the factors that South Asian countries must consider in their next steps toward successful implementation of competence-based vocational and professional education.

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Chapter 22
Competence-based Vocational Education and Training in Viet Nam: Input and Process towards Learning Outcomes

Nguyen Quang Viet

22.1 Introduction

Schemes for improving the quality of human resources in general, and the quality of employees who possess occupational skills which are recognized by other nations and employers within certain regions, facilitate labour migration. In that sense they are beneficial for outgoing and incoming migrant employees. It is therefore helpful for member states in the Association of Southeast Asian Nations (ASEAN) to harmonize standards on occupational skills and competencies to establish mutual recognition of employee qualifications in certain professions. This has been mentioned in meetings and conferences of the ASEAN several times since the 1990s.

Like many other countries, Viet Nam is facing new challenges in human resource development. Despite impressive achievements in literacy and numeracy among Vietnamese workers, many Vietnamese firms report difficulties in finding workers with adequate skills and regard this as a significant obstacle in their activity (World Bank 2013). The White Book 2014 on Trade/Investment Issues and Recommendations also indicates that Viet Nam ranks in the lower half of human resources within the ASEAN member states (European Chamber of Commerce 2013). The issue of mutual recognition of qualifications and skills between the member states is raised and a process is going on of getting a common arrangement to promote skilled labour mobility within the region. One of the basic notions in this process is that manpower quality is comprised of skills and competencies of workers. Therefore, improving and updating skills and competencies is a key mission of the Viet Nam VET system, to meet the needs of a rapidly changing labour market.

See Appendix for List of Abbreviations.

N.Q. Viet (✉)
National Institute for Vocational Training (NIVT), Ha Noi, Viet Nam
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In recent years, there has been a remarkable innovation in training programmes and methods, but the assessment of learning outcomes has lagged behind. The assessment practiced strongly relies on the capacity of trainers and the qualities of infrastructure and facilities, which are not complying with the standards set forth by current advances in technology and the state of the industry. Most trainers are not competent because they lack practical working experience. Many VET institutions do not have adequate tools and equipment, or what they have is not functional. As a result, learning outcomes of students do not properly reflect the current competencies required by the labour market. The Government is committed to implement a policy comprising of a comprehensive reform towards a competence approach in education and training.

22.2 Context of ASEAN Integration

The ASEAN member states have a combined population of almost 630 million people. There are considerable differences in the population levels, size of economies and levels of per capita income across countries. The ASEAN Charter aims to develop human resources through closer cooperation in education and lifelong learning and in science and technology, for the empowerment of the peoples in the member states of the ASEAN and for the strengthening of the ASEAN Community and to enhance the well-being and livelihood of the peoples of ASEAN by providing them equitable access to opportunities for human development, social welfare and justice. Between 1990 and 2013, intra-ASEAN migration increased from 1.5 million to 6.5 million people, with Malaysia, Singapore and Thailand emerging as major migration hubs. Most migrant workers are low- and medium-skilled, and the main drivers are economic and demographic disparities among the member states. Some countries of origin have expanding youth populations, which place pressure on the labour market to create jobs and can lead to outmigration of young women and men. In the destination countries, the demand for migrants has increased due to population ageing, which can lead to labour shortages. Current ASEAN Economic Community (AEC) policies for managing migration are confined to high-skill occupations.

The main tools for achieving labour mobility under the AEC are likely to be the mutual recognition arrangements (MRAs). These establish the skills or experience relevant professionals need to gain certification in another country and ultimately to work abroad. There have been mutual recognition arrangements (MRAs) in eight occupational categories: engineering services, nursing services, architectural services, surveying qualifications, medical practitioners, dental practitioners, accountancy services and tourism professionals. But since these together account for a tiny share of total employment, the AEC's provisions on labour mobility may have limited short-term impact. Migration of low- and medium-skilled workers is likely to continue and even increase (ADB & ILO 2014).

In support of the MRAs, ASEAN is developing the ASEAN Qualifications Reference Framework (AQRF) that will enable qualifications to be compared across

Member States while providing a coherent benchmark for current national qualifications frameworks (NQFs). The AQRF was endorsed by Ministers of Economy (August 2014) and Ministers of Education (September 2014). And the ad referendum endorsement of the AQRF by the ASEAN Labour Ministers was completed in May 2015. The basis for AQRF is derived from the ASEAN Charter signed by the ten ASEAN leaders in Singapore on 20 November 2007, where aspirations to become a single entity that is ASEAN Community was reinforced. Also in 2007, the ASEAN Economic Blueprint was signed by member countries. It called for areas of cooperation, including the recognition of professional qualifications. Another important component of the blueprint was the creation of the free flow of skilled labour through 'harmonisation and standardisation', particularly in preparation for the AEC 2015.

22.3 The Discourse on Competence-based Training and Assessment in VET

As noted in many chapters in this volume, the terms competence and competency are complex. However, the concept of competence is widely applied in defining performance, certainly in VET.

The landscape of VET in Viet Nam reveals a variety of terminologies, which sometimes may even appear confusing. The terminology includes occupational standards, competence standards, skills standards, occupational skills standards and achievement standards. Another area of confusion for some people is the relationship between learning outcomes and competence. Some people prefer to use the term competence-based qualifications when referring to qualifications that are described in terms of learning outcomes. Competence-based qualifications are fundamentally a statement that a person is qualified to work in a specific field or occupation. It is important to see the definition of learning outcomes as one key step towards defining competence-based qualifications. In other words, competence-based qualifications are one example of how learning outcomes-based approaches are used (CEDEFOP 2011).

Notwithstanding the diversity in competence definitions, there is a quite common understanding of it in Viet Nam, which is the ability to perform the duties and tasks to an occupational standard set (Nguyen Duc Tri 2010). Competence covers integrated knowledge, skills and attitudes. However, the competence cannot be undetermined by term 'ability'. It has to be demonstrated in reality by realizing one's potential and showing evidence of being competent by performance. Furthermore, competence is the combination of physiological and psychological attributes and specialized qualifications that have been demonstrated completing one or more tasks in accordance with the corresponding standards within the actual workplace context (Dang Thanh Hung 2010; Nguyen Quang Viet 2014).

Professional competence comprises of four key dimensions: task performance, task management, contingency management and job environment.

To elaborate on these a bit further, these are the short descriptions of these dimensions:

1. Task performance competence: involving criteria of process, product or service, working safety and labour productivity.
2. Task management competence: responding to workplace arrangements, preparation and preservation of equipment and materials, industrial hygiene practice, recording and writing documents as prescribed under regulation and individual responsibility as well.
3. Contingency management competence: considering criteria of process and results of situations and problem solving that respond to irregularities and breakdowns in routine, encompassing the skills used in day-to-day employment.
4. Job environment competence: working in a team and communicating with others as colleagues, customers and the public.

Competences are identified and described in the competence frameworks, which serve as the standard for each industry to measure the quality of task performance in the work context. Competence standards define the skills and knowledge required for competent performance in an industry. These standards describe the skills, knowledge, behaviours and attitudes that a person has to possess to perform the key task in the workplace. The competence standards also indicate the situation, performance conditions and levels of responsibility and autonomy to perform tasks. Competence-based achievement assessment is a process of gathering evidence and making judgement on the nature and scope of progress of a trainee corresponding the performance criteria set by the competence standards of an occupation.

In the case of Viet Nam, national occupational skills standards (NOSS) are focal reference points specifying the outcomes of VET, which are aligned to qualified graduates' need to meet for a specific occupation. Deriving from that, NOSS are the starting point for developing demand-oriented VET programmes and also the end point of VET delivery as reference for assessment and certification. NOSS define the expected VET outcomes from an employers' perspective (these are the so-called learning outcomes). On the other side, VET standards facilitate achievement of the expected VET outcomes through demand-oriented VET delivery (input/process oriented standards). VET standards can be characterized as minimum requirements related to important elements of outcome-based VET delivery, such as learning outcomes, VET trainers and managers, training infrastructure, curricula, etc.

22.4 Competence-oriented Approached in VET Policy in Viet Nam

Viet Nam enacted a Law on VET in July 2015, which replaced the Vocational Training Act of 2007. The VET Law distinguishes sub-qualifications systems. Before July 2015, according to the Education Law of 2005 and the Vocational Training Act of 2007, vocational training institutions were classified into three types

according to qualifications they offered. They were (1) vocational training centres, (2) vocational schools and 3. vocational colleges.

The systems responsibility for VET is divided over the Ministry of Education and Training (MOET) and Ministry of Labour, Invalids and Social Affairs (MOLISA). MOET is responsible for professional secondary education, along with professional secondary schools and colleges. On the other hand, MOLISA handles everything concerning vocational training at the levels of primary, intermediate and collegiate training. The term vocational training is used synonymously with VET in Viet Nam, and vocational training programmes with a duration of over one year are provided within the regular education system under the management of MOLISA.

Another institution type is college that belongs to higher education. Since July 2015 VET is defined as an integral part of the national education system with the aim to deliver programmes at primary, secondary and collegiate levels and other professional workplace training for employees, to meet the demand of the workforce in direct production, business and services. Viet Nam would have only one single type of VET at college level as well as intermediate level. There is no longer a college in higher education. Every VET institution must be autonomous and has a defined set of learning outcomes on which curricula are based which consists of modules with a certain amount of credits. Learning outcomes would be based on NOSSs and translated into industry, curriculum, modules, lessons and learning steps plans. This makes VET more flexible in meeting labour market demand, although there is an issue as to how to integrate two approaches to address competence development: (1) the economic sector-based approach and (2) the occupation-based approach.

VET programmes have to meet the following criteria: (1) describe objectives of elementary, secondary, collegial-level VET; stipulate outcome standards on knowledge, skills for graduates; scope and structure of contents, method and form of VET; learning outcomes assessment method for each module, subject, occupation and qualifications level; (2) ensure the scientific characteristics, modernity, systematic, practicality, flexibility responding to changes of labour market, distribute reasonably and appropriately time span between occupational knowledge and skills and create favourable conditions for the permeability between VET qualifications levels and with other training qualifications levels in the national education system; and (3) must be reviewed, updated and supplemented on a periodical basis in line with coming techniques, technology in production and services. The head of the central state management agency in VET stipulates the minimum volume of knowledge and competence requirements that trainees must gain upon their graduation corresponding to each qualifications level and the procedures for development, appraisal and issuance of VET programmes.

The Government of Viet Nam has endorsed the introduction of the NOSS-based approach in order to improve the quality of VET. The development of NOSSs was foreshadowed in Chapter IX of the Law on Vocation Training. ‘The NOSSs are the base on which workers can improve their skills, meeting the increasing demand of production and trading, employers can assign different jobs for and correspondingly

remunerate workers; the standards also help increase the competitiveness of the business in international integration; based on those standards, vocational training programmes can be established in accordance with production and trading requirements' (Clause 2 of Article 79).

The adoption of the national law is a significant shift from the previous arrangements governing VET in Viet Nam. MOLISA, in accordance with its specified obligations under this law, has developed the operational machinery to enable implementation of NOSS and an associated certification system through which skills and competencies can be formally recognized. Development of NOSS is governed by ministries and sectors in collaboration with relevant occupational agencies and associations. The occupations of different fields are assigned to ministries and industries which are affiliated to these fields. MOLISA is responsible for initiating principles and processes and guiding of other ministries and industries to develop NOSS and for managing NOSS after they have been agreed. The Decision no. 09/2008/QĐ-BLDTBXH dated 27 March 2008 defines principles, procedures of developing and issuing NOSSs for each occupation.

Thus, NOSS consist of regulations at performance level and are requirements of essential knowledge, critical skills and attitudes to perform the tasks of an occupation. Ministers, Heads of Ministry-equivalent offices, Heads of Government's offices (hereinafter commonly called Ministers) host and coordinate relevant offices and trade associations to develop and issue NOSSs under the regulations of the Vocational Training Law. The Ministers and other responsible stakeholders just mentioned, in cooperation with related vocational institutions and associations, manage the establishment and enactment of NOSS for each occupation. These regulations are central in the establishment and implementation of a national standards-based vocational training system and are consistent with the provisions of the national law described above. In these regulations, the General Directorate of Vocational Training (GDVT) of MOLISA is assigned overall responsibility for the management and administration of the system.

The regulations prescribe that NOSS are developed for defined occupations and skill levels. Skill levels enable career progression because there are logical pathways within an occupationally relevant skills set. Unlike the more system-wide approaches that have been adopted in some other economies, Viet Nam is aiming to further develop these logical pathways which are particularly relevant for a given occupational level. Other countries have opted for a generic skill or cross-occupational approach. It is the opinion of the Vietnamese stakeholders that standards need to be developed in a consistent format and be capable of alignment to regional and international occupational standards. The regulations prescribe five levels of qualifications with minimum requirements prescribed at each level (Table 22.1). Progression between levels is based on achievement and demonstration of skills which are externally assessed. This results in training provision which meets these requirements and responsiveness of the education system to the needs of employers and to more quickly address their priorities through the revised system.

Table 22.1 Viet Nam occupational skill qualifications framework descriptors

Levels	Requirements
Level 1	(a) Be competent in performing simple and repetitive tasks within one occupation
	(b) Understands and has basic knowledge in a narrow range of operations of an occupation of some areas; can apply some specific knowledge when carrying out the task
	(c) Be able to receive, take note and transfer information as required; take limited responsibility for outcome, output of self
Level 2	(a) Be competent in performing simple and repetitive tasks and few complicated tasks in a defined range of situations under guidance
	(b) Understands and has some basic knowledge of operations of an occupation; can apply some professional knowledge and be able to come up with some solutions to solve normal issues in their work
	(c) Be able to consider, predict and explain information; can work in team, can work independently in some cases and take most of the responsibility for outcome, output of self
Level 3	(a) Be competent in performing different tasks, most of which are complex and major in a range of options; can work independently without guidance
	(b) Understands and has knowledge of basic theoretical concepts, professional knowledge of the occupation; can apply professional knowledge and be able to identify to apply knowledge to deal, solve normal issues in a variety of contexts
	(c) Can identify, classify, analyze and evaluate information from different sources; be able to give direction for others in the working team or group; take responsibility for output of self with specified quality standards and can take limited responsibility for output of others in the working team or group
Level 4	(a) Be competent in performing a broad range of varied tasks, most of which are complex and major in a range of different options, can work independently without supervision and guidance
	(b) Understands and possesses broad knowledge of basic theoretical concepts and has deep professional knowledge in different areas of the occupation; be able to transfer and apply creative knowledge and skills to deal with complex technical issues in a variety of contexts
	(c) Can analyze, evaluate information and can use analysis to come up with ideas, recommendations serving for the sake of research and management; be able to manage and run the working team or group when performing the work; take responsibility for outcome, output of self with specified quality standards and take limited responsibility for outcome, output of the working team or group
Level 5	(a) Be competent in performing all varied tasks of the occupation fluently and skilfully; work with high independence, great self-control
	(b) Has broad knowledge of basic theoretical concepts and has deep professional knowledge in many areas of the occupation; has techniques for analyzing, forecasting, designing, considering to solve both technical and management problems in a wide scope
	(c) Can analyze, evaluate and generalization information to come up with opinions and initiatives; manage and run the working team or group when performing the work; take responsibility for outcome, output of self with specified standard quality and take responsibility for output of the working team or group in accordance with specified standards and specifications

Source: Drawn by the author according to Decision No. 09/2008/QĐ-BLĐTBXH of MOLISA on principles, procedures of developing and issuing national occupational skills standards, 2008

22.5 Main Issues of Competence-based VET Implementation

For professional secondary education institutions, MOET provides the national curriculum which is similar to programme standards. These standards include: an introduction, general objectives of qualification, learning outcomes, subject or knowledge required to be learned, duration, assessment guide, requirements of the teachers and equipment, facilities and textbook advice. These programme standards are developed through a committee process. The committee is initiated through the MOET and incorporates those teachings in the area, experts and one or two industry expert representatives. From these programme standards, individual education institutions are to develop their own detailed curriculum within an internal quality management system.

For vocational training institutions, MOLISA is responsible for developing the national curriculum frameworks. The curriculum development process is more closely aligned to occupational, job and functional analysis. MOLISA convenes meetings and workshops with VET institutions, companies and university experts to identify job tasks and duties to develop into the curriculum. The curriculum includes essential knowledge and critical skills as learning objectives, assessment guide and criteria including performance criteria and duration and modules/subjects detail. The curriculum may be based on NOSS if they are developed in that particular occupational field. However, it can happen that the curriculum has been developed before the competence framework.

The curricula specify generic subjects that all students have to take for each qualification, such as information technology, foreign languages, physical education, politics and law and national defence/security. These subjects are taught at diploma and advanced diploma qualifications levels; however, subject complexity and duration vary across the qualifications levels.

Although VET curriculum frameworks have been developed using DACUM (Development of A Curriculum), job analysis modules and subject structure is not so flexible to meet students' learning need and ability. Many modules are not designed in relation to the competence standards but structured following disciplines, theories and lesson exercises and do not fully have integrated knowledge, skills and professional attitudes. Furthermore, there is a relatively large difference between competence assessment done by VET institutions and employers. This indicates that the assessment of learning achievement is often not aligned to the outcomes which are included in the competence standards, which are regulated by employers' associations, but that this heavily relies on the experience of trainers and facilities available in VET institutions. Because of limited financial resources, facilities and equipment used for practical training are technological backward. Thus, the necessary conditions for learners to develop meaningful competence are not fulfilled, and because of that assessment results are usually only valid within the institutions in which (often) inadequate competence is tested, which actually leads to qualifying partial incompetence. On top of that it appeared that the majority of VET trainers have little current working experience in the fields in which they are teaching, have only little understanding of NOSS, and have not been trained in

teaching and assessment in a competence-based education and assessment context. Group-based training and assessment is an example proving this limitation. Most learning groups are facility shared due to equipment and materials privation. The trainer also does not know how many people needed to perform the task to occupational standards, what division of work between members should reflect practically employment, etc. (Nguyen Quang Viet 2014).

22.6 Viet Nam National Qualifications Framework Progress

The ASEAN region is typical for other regions around the world which try to development NQFs. Some countries have established comprehensive NQFs, while others have a well-established sectorial framework; still others are yet to develop or implement qualifications frameworks. Within this context the ASEAN Qualifications Reference Framework (AQRF) aims to accommodate different types of NQFs that are at different stages of development, ranging from those that are initial conceptual proposals to those that are fully developed and functioning.

The final text of the 4th AQRF Meeting stated that '… the purpose of the AQRF is to enable comparisons of qualifications across AMS that will support recognition of qualifications, encourage the development of qualifications frameworks that can facilitate lifelong learning, encourage the development of national approaches to validating learning gained outside formal education, promote and encourage education and learner mobility, promote worker mobility, lead to better understood qualifications systems and promote higher-quality qualifications systems.

The AQRF will support and enhance each Member State's national qualifications framework or qualifications system while providing a mechanism to facilitate comparison, transparency and higher-quality qualifications systems. This is achieved through: a process of peer learning across AMS, for example, in design and operation of qualifications systems, a better understanding of a Member State's national qualifications system, for example, by making it clearer to those in other AMS and through applying quality processes used in other AMS.

The AQRF will link the ASEAN NQFs or qualifications systems and become a part of the ASEAN's mechanism for recognition of its qualifications against other regional qualifications systems'.

The level descriptors of the AQRF aim to provide a reference point for the levels in NQFs and national qualifications systems. To facilitate the referencing process in the AQRF is based on broad level descriptors which includes eight levels of complexity of learning outcomes.

The level descriptors include the notion of competence, which is the ability that extends beyond the possession of knowledge and skills. It includes:

- *Cognitive competence* involving the use of theory and concepts, as well as informal tacit knowledge gained experientially

- *Functional competence* (skills or know-how), those things that a person should be able to do when they work in a given area
- *Personal competence* involving knowing how to conduct oneself in a specific situation
- *Ethical competence* involving the possession of certain personal and professional values (Coles and Werquin 2006)

The level descriptors include two domains: (1) knowledge and skills and (2) application and responsibility.

The knowledge and skills domain includes the various kinds of knowledge such as facts and theories as well as the skills used, such as practical and cognitive skills.

The Application and Responsibility domain defines the context in which the knowledge and skills are used in practice; as well as the level of independence including the capacity to make decisions and the responsibility for oneself and others.

The level descriptors assume that the learning outcomes are cumulative by level, in other words, one level assumes that the knowledge, skills and conditions at one level include those at the lower levels. In addition, the domains must be read together to give a true indication of level.

In that context, Viet Nam is working on the development of its NQF. That is very important since the country has no clear definitions of qualifications framework so far. It is an education system structure complicated with qualifications levels defined by laws. It is unclear and not transparent. There is no single unity formula to define qualifications. There are no descriptors of each type of qualifications level. In spite of having qualifications names, it is quite difficult to measure the breadth, depth and complexity of knowledge and competencies and there is no taxonomy for each level (Nguyen Quang Viet 2014). Each qualification is not based on learning outcomes defined transparently among qualifications. Reality has shown that the national educational and training system has lacked consistency, which leads to the fact that human resource training quality fails to satisfy employers. Training has not been aligned with labour market demand; qualifications have not precisely reflected learner's competence. Stagnancy in developing and adopting the NQF is one of major reasons for this situation.

NQF refers to requirements of levels of training, knowledge, skills, autonomy and responsibility of learners; learning volume and credentials system corresponding to each level. Development and adoption of Viet Nam NQF would form an essential base to unify the education and training system, VET sub-system in particular, to improve quality and efficiency to be equal to requirements of international integration and cooperation.

As part of this process, the Viet Nam Government has commissioned MOET and MOLISA to ensure that a single framework will be based on learning outcomes and cover both higher education and VET. Learning outcomes are clear statements of what a learner can be expected to know, understand and/or do as a result of a learning experience. The structure of the framework includes eight levels and will include three levels of certificates (level 1, level 2 and level 3), diploma, advanced diploma

and bachelor, masters and doctorate qualifications levels. The question is how to integrate NQF into NOSS as NQF describes through knowledge, skills and attitude that a graduate needs to have and to demonstrate. Learning outcomes approach is an answer for that question.

22.7 Solutions to Competence-based VET in Viet Nam

22.7.1 Moving Towards a Learning Outcomes Approach: The Way Forward

A major driver for reform of VET is the need to improve the relevance and attractiveness of VET qualifications in uncertain labour market conditions. Governments, providers and other stakeholders are seeking to meet more effectively the demand for knowledge, skills and qualifications, even when stakeholders lack clarity as to precisely what kinds of skill and qualification are needed, and at what levels. Most countries refer to learning outcomes (in their own terms) as an increasingly important or key defining factor in developing qualifications. Analysis of occupations, in the context of national institutions and approaches, is used to develop and/or update relevant competence standards. They are then interpreted into the learning outcomes expected for the different vocational qualifications corresponding to those occupations. In some cases a training standard is also developed (CEDEFOP 2009).

Globally, there has been a shift to learning outcomes as the basis of NQFs and regional common reference frameworks. Learning outcomes support the transfer of qualifications, including credit transfer and recognition of non-formal and informal learning. The AQRF is a hierarchy of levels of complexity of learning which use learning outcomes as the metric for the hierarchy. To use other measures such as duration of programmes is not a feasible option. Thus, the descriptors in the AQRF aim to fuse learning outcomes to facilitate comparisons of and links between qualifications and qualifications systems across AMS. Some are using an outcomes approach to VET qualification reform through developing partial or national qualifications frameworks, while others are using catalogues of occupations and qualifications (CEDEFOP 2009).

Learning outcomes are the expression of the set of knowledge, skills and the application of the knowledge and skills a person has acquired and is able to demonstrate as a result of learning. Learning outcomes can be called as the heart of competence-based VET. The focus is thus shifted from what is being taught and how it is being taught (input) to what a student will know and will be able to do (output/outcome). Qualification standards are formulated increasingly as learning outcomes. By considering standards to be outcome-oriented when they include a set of knowledge, skills or competences to be attained, irrespective of their name (learning objectives, performance standards, learning outcomes, etc.). A degree of confusion seems to persist regarding the difference between output and outcome of

education and training. Output can be defined as the results of learning in an educational context, whereas the outcome of learning is the ability of an individual to implement what he or she has learned in a 'real life' professional context (Coles and Bateman 2015).

In VET sector learning outcomes are translated competence standards into curriculum.

In the case of Viet Nam, a learning outcomes-based curriculum development should be implemented as following procedure (Fig. 22.1).

The modules are developed from competence standards units to specify training objectives on learning outcomes. The performance standard in the existing NOSS often associated with each individual task would be converted to format of competence standard. What should be considered when converting task performance standard into competence standards is determining the elements (any of the basic building blocks of a competence unit, which describe the key activities that must be performed to demonstrate competence in the tasks by the unit) and the scope of application of such unit. The performance criteria specify the required level of performance to be demonstrated by trainees or workers to be deemed competent. Range of applications specifies contexts and conditions to which the performance criteria apply. Then the modules should be clearly defined outcomes corresponding to the competence unit. In short, the elements would become the learning outcomes of the module, the performance criteria would become assessment criteria and evidence guidelines and the application context would be the determination of the materials, training and assessment methods and conditions (Fig. 22.2).

In order to achieve the above solution, the transition from the existing NOSS into competence standards needs the participation of experts in the industry. And also trainers not only are qualified at required professional level, but also need to be guided to develop competence-based curriculum.

22.7.2 The Process of Developing Competence Performance Assessment Tools

Development of competence performance assessment tools is five step process (Fig. 22.3). Due to the limitations of the existing programmes module structure as discussed above so that should be harmonized the objectives and content of the modules and performance standards in NOSS.

Step 1: Analysis of the module's objectives.

Determine the tasks and skills required for the module. This information would help to decide the number of practical assessment items for the module.

Step 2: Determine the number of practice tests for the module.

Practice samples for assessment should represent the range of task or skills of the module. Deciding about the relative importance of the task of the module. In case

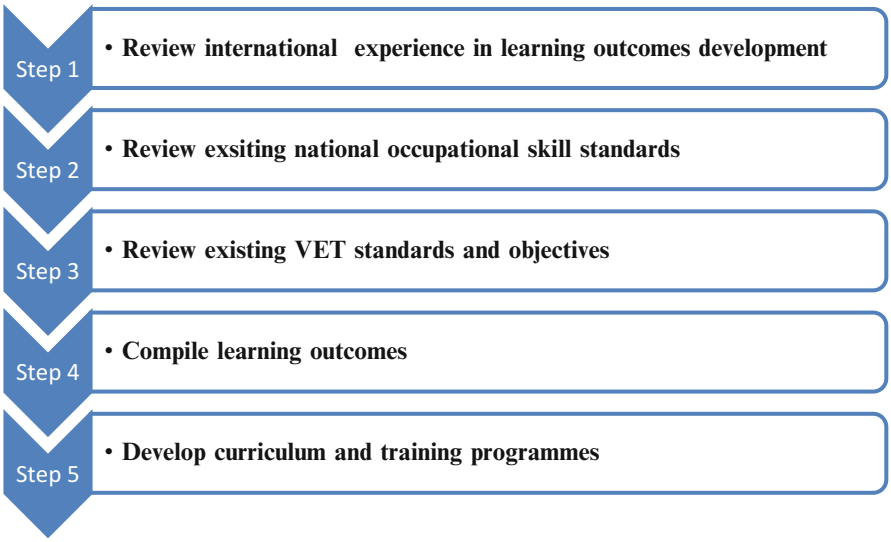

Fig. 22.1 Procedure of learning outcomes-based curriculum development

Competence Standard		Module title
Competence unit	*becomes*	Module
Elements	*become*	Objectives Learning outcomes
Performance criteria	*become*	Assessment criteria Method of delivery Learning resources
Evidence guide	*becomes*	Method of assessment Conditions
Range of variable	*becomes*	Situation Coverage

Fig. 22.2 Translation competence standard into module

module has large number of tasks it should be considered to determine more action samples drawn from this module.

Step 3: Determine the time and sample of skills for each practice test.

The time is normal 2–6 h for practical test, depending on the number of tasks allocated to the candidate and the time required to complete each task. The amount

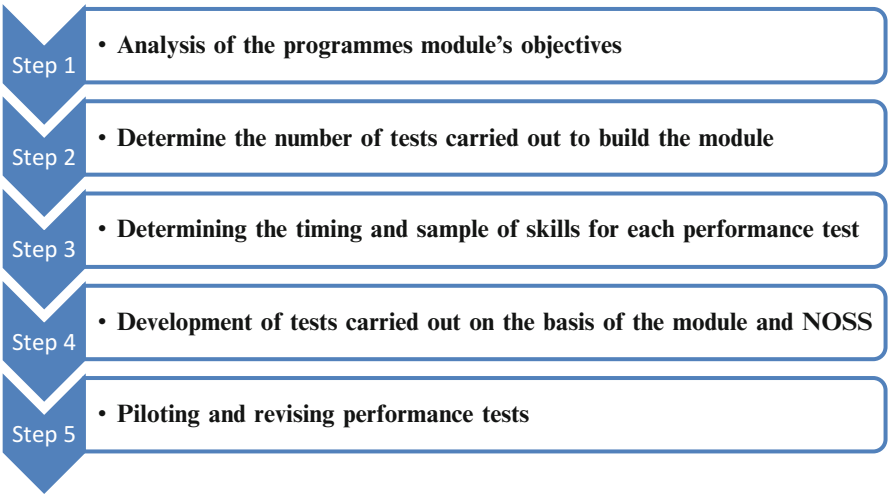

Fig. 22.3 The process of developing competence performance assessment tools

of practice tasks must be enough representative to make sure that a person has demonstrated the concerned competence by the module's objectives. Gathering a sample of skills in the exam pattern is typical.

Step 4: Develop the performance test based on module's objectives and NOSS.

Selecting task performance standards needed to assess. Use information on task performance standards to develop practical test.

Step 5: Piloting and adjustment of the practical tests

There are many methods and tools used in competence-based assessment, but observation and oral test at the practice area are two main methods providing valid and reliable direct evidence that reflect elements and aspects of the competency. And the two main tools used are a checklist and oral questions.

Conditions for the process are identifying skills needs to assess, assessment criteria, oral questions; duration of test and assessment context requires the participation of experts in industry. Assessment methods, tools and conditions do not cause too costly in time and resources.

22.7.3 Competence-based Assessment of Group According to the Division of Labour and Production Organization in the Occupational Area

Assessment of the group aims to assess the demonstration of the coordination capacity and level of responsibility in performing the task, while encouraging social behaviour according to the norms of professional activities. The contents of the method are as follows:

- A group must have a sufficient number of candidates to perform the task according to the division of labour and production processes. If the task performance standard has not indicated the number of group members, the trainers and the institution need to consult with professionals in the field.
- Apart from the number of group members, trainers need to determine the number of groups ensuring that space and working conditions of each group can be observed and monitored. The group set followed the career action pattern: a group of peer individuals and some assistants or group of peer members working together under supervision of the leader, someone has a role play as a customer, etc.

Conditions for the method: the determination of the structure and the number of group members according to the division of labour and production organization must have the participation of experts in the industry. Trainers need to receive guidelines on the process and techniques of assessment tools development. Have a spare candidate in case that someone cannot continue to participate in the assessment process.

22.8 Conclusions

The government should: issue the NQF to create a system of qualifications which is understandable for apprentices, employers and institutions; build the confidence of the public towards qualification through the provision of quality assurance framework of the VET qualifications levels; provide standards for the types and levels of qualifications; and support the recognition of knowledge, skills and competencies to collect enough credits for a given training level. There should be policies to attract good professionals from businesses who will be involved in practical training and-curriculum development. It is important to define the competencies which are needed in training programmes and assessments of learning outcomes. In particular, mechanisms need to be in place which enable building partnerships through the practice period, which is the period of competence training and development in the workplace.

The MOLISA and its General Directorate of Vocational Training (GDVT) should: develop and promulgate professional standards for VET trainers, thereby

identifying competence gaps of the trainers and investing in capacity building for those who do not meet the standards; develop guidance documents and deliver upgrading courses for VET managers, trainers and business professionals who are working on competence-based education and assessment. Professional competence standards should be developed according to the job positions as well as the structure of the competence unit which are similar to the regional and international ones for reasons of comparison, benchmarking and mutual recognition of qualifications between countries. Regarding these, the ILO Regional Model of Competency Standards (RMCS) may be considered to be contextualized for Viet Nam.

Furthermore, the business community should actively participate in the development of competence standards as well as in the VET programmes in fields in which they are working. Enterprises would also dispatch their professionals to be directly involved in the training and assessment of learning outcomes. They should also actively work with VET institutions in establishing partnerships through the practice period of trainees.

The VET institutions should facilitate their trainers to participate in continuing professional development, and to engage in business activities in the field they are teaching. VET managers and trainers should study competence standards, to be trained in developing competence-based education programmes and assessment. The universities/institutes of VET teacher education should update and adjust their training programmes so as to include literature on and practice with competence-based education and assessment, particularly on the learning outcomes approach for curriculum design and development. Starting VET teachers should also have to do an internship, not only at the VET institutions, but also in enterprises. There should be training specifications for this, and the time dedicated for this workplace learning should be increased.

List of Abbreviations

ADB	Asian Development Bank
AEC	ASEAN Economic Community
AQRF	ASEAN Qualifications Reference Framework
ASEAN	Association of Southeast Asian Nations
CEDEFOP	European Centre for the Development of Vocational Training
GDVT	General Directorate of Vocational Training
ILO	International Labour Organization
MOLISA	Ministry of Labour, Invalids and Social Affairs
MOET	Ministry of Education and Training
MRA	Mutual Recognition Arrangement
NOSS	National Occupational Skill Standards
NQF	National Qualifications Framework
RMCS	Regional Model of Competency Standards
VET	Vocational Education and Training

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Chapter 23
Competence and TVET Innovation in Sub-Saharan Africa: The Case of Rwanda

Wybe van Halsema

23.1 Introduction

It is expected that by 2050, sub-Saharan Africa will have a larger and younger workforce than China or India (ACET 2014). This workforce, in combination with comparative economic advantages such as the abundance of natural resources on the continent, signifies a development opportunity for sub-Saharan Africa to grow in importance on a global scale. It is believed that through stimulation of industrialisation and the development of a service-oriented economy, many new jobs can be created outside the primary sector. Obviously, job creation serves not only economic purposes but also social purposes. For many countries in sub-Saharan Africa, a scenario whereby a large proportion of the youth would remain unemployed would be a dark one. Education and skills development are considered crucial elements for economic development *and* for social stability in the near future.

Rwanda, in terms of its enrolment performance towards the education-for-all millennium goal, is representative for sub-Saharan Africa (Filmer et al. 2014): more than 70 % primary school completion rates coming from less than 50 % 20 years ago. Unfortunately, the generally poor quality of this education makes that up to now, schooling has relatively small effects on productivity and poverty reduction (op cit. p. 67). Technical and vocational education and training (TVET) is at the centre of socio-economic development strategies of many African governments as a more focused approach to building worthy human capital amongst youth. In Rwanda, the government has introduced some important changes that attempt to transform the relationship of educational credentials to employment. The creation of the Workforce Development Authority (WDA) in 2008 embodies the restructuring

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of the TVET system towards more modular and practical, labour market-responsive courses (Paxton 2012). Central to this approach is the notion of *competence*.

The concept of competence has been 'imported' from the West with its well-developed, highly diversified job markets. Competence is then seen as a 'unit' or endowment of human capital in demand by the labour market for specific jobs, which is transferable via TVET. For curriculum developers, it holds a promise of structuring educational programmes in such a way, that this competence is reproducible and can be generalised. For governments it suggests the possibility to centrally plan for it via manpower planning and requirement forecasting, rate-of-return analysis or labour market information studies (LMIS). It also suggests the possibility to measure its effectiveness via tracer studies and return-on-investment studies. CBE can ultimately be considered as an approach or educational philosophy that is intended to result in competent graduates. The concept of 'competence' refers in generic sense to the 'quality or state of being competent' (Kouwenhoven 2003, p. 43), but is often related to a specific domain (context specific). Mulder (2014) refers to *professional competence* in a behavioural manner and defines a person as being *competent* when he or she acts responsibly and effectively according to given standards of performance. It is seen as a generic, integrated and internalised capacity of a worker or learner to deliver worthy or value-adding performance in a given professional domain. People can be competent in different domains, hence the possibility to use the plural: *competencies*. Mulder (2007), based on a thorough study of over 40 definitions of the concept of competence, distinguishes between *competence* and *competency*. The former is then seen as the generic capability of persons or organisations to perform, a capability that is developing as a result of integrative learning, whereas the term 'competency' is considered a more specific, task-related capability within the general competence for a job with a coherent set of tasks.

The Central African republic of Rwanda applies its specific notion of competence more in a behaviouristic way and more as an engineering element in a TVET-system reform. The government wants to achieve the status of middle-income country by 2020 and intends to strongly develop its formal economy and job market. The country is successful in implementing regulations and tax-collection practices and performs well on several economic and accountability indicators. This ambitious development agenda includes, however, the discouragement of manifestations of the informal economy. Rwanda has a distinct profile compared to neighbouring states, and has a strongly government-directed and control-oriented culture of central planning and obedience. McKay (2005) refers to this characteristic as an important element of the *developmental state* that partly explains the initial success of the South Korean economy and their TVET model. In the developmental state, education is often considered important for creating national identity and pride, enhancing a general determination to succeed and stabilise the regime through a targeted process of strong economic growth driven by job creation and job-oriented TVET. Given the recent Rwandan history of genocide and civil war and the ongoing security menaces in the great lakes region, these elements are valid for Rwanda too. Making comparison between the two countries (South Korea then and Rwanda now), the following similarities effervesce: a strong human capital approach to TVET,

stressing the centrality of education and skills in all aspects of development; a close relationship between planning targets of education with those of job creation; the recognition of education, including TVET, as the key mechanism for the social and economic mobility of individuals, and an export-oriented urge for permanent restructuring and adaptation. When McKay (2005) tries to identify key success factors and lessons from the South Korean experience for Africa, he wisely states that it is not advisable to take any successful feature from any other region and bolt it to the existing systems of an African country. Without thorough analysis of the context and consequent adaptation of the features to be imported, this is doomed to fail. For sub-Saharan Africa, despite ambitious planning and a growing mass of support in terms of financial and human resources made available, the expansion of TVET rarely follows the set targets. ACET (2014) states that apart for Mauritius, TVET enrolment numbers generally do not match the rising aspirations of industrialisation.

In the next section, it is argued that only by targeting various levels of intervention that are interlinked and conditional for competence-based learning to take place, durable change could be expected. In an attempt to facilitate the TVET reform in Rwanda, the Belgian Technical Cooperation (BTC) implemented a comprehensive development programme (2010–2015). The implementation of this programme is used as a case study to evaluate the use of 'competence' as leading principle in TVET reform in sub-Saharan Africa, and specifically in Rwanda.

23.2 Developing *Competence* in Rwanda: A Systems Approach

For TVET to be labour market relevant, it must be of a certain quality. This quality of TVET has an unequivocal linkage to the quality of prior education. Zambia, as an example, has an impressive primary school completion rate of 100 % in 2011. However, when the basic competencies *math* and *reading* of school leavers are tested independently, Zambia scores lowest in basic numeracy, very low in beginning numeracy and extremely low in competent and above levels. The same goes for reading, where Zambia comes second to Malawi in basic reading levels, with extreme low capabilities for reading for meaning and even worse for interpretive and above levels (Filmer et al. 2014, pp. 68–77). Statistics are not necessarily the best indicator for the quality of TVET being implemented. An enrolment rate of 100 % is encouraging but nevertheless insignificant if no relevant learning takes place. Having curricula in TVET that are 100 % competence based is a good start, but if the capacity to understand and deliver these curricula is not present at schools, they remain impracticable documents. If the targeted 25 % of the TVET teachers receive training in competence-based pedagogy but are not facilitated by their school managers nor allowed to apply different forms of assessment, the training probably has little impact. The aforementioned numbers are real targets for the

Rwandan TVET sector to be reached by 2018 (RoR 2013). It is argued that when aiming for TVET reform, it is essential to address issues at different interrelated institutional levels simultaneously or, in other words, pursue a systems approach to TVET reform and aim for durable quality improvement.

The Belgian TVET Support Programme in Rwanda (PAFP) ran with a budget of 11 million euro and about 30 staff. About half of these staff were technical experts in various TVET areas such as school management, competence-based pedagogies, teacher training (ToT), business development and information systems for sector-monitoring or tracing graduates. At the core of the TVET-system reform are the vocational training centres (VTCs) where TVET actually takes place and where quality improvement is expected to have a direct bearing on the employability of graduates. PAFP worked with 24 pilot schools in the Southern Province, covering ten districts. Other intervention levels concerned higher institutional levels on which the schools depend, also called *the upstream*; the relationships with employers and businesses could be marked as *the downstream*. In the upstream, PAFP intervened at the provincial level (Integrated Polytechnic Regional Centre: IPRC) and national level (Workforce Development Authority: WDA) with institutional support aimed at introducing and improving competence-based TVET in the schools. The IPRCs represent larger regional polytechnics offering courses up to the diploma level; this should promote horizontal and vertical mobility of learners. According to their second mandate, IPRC assures the coordination and support of TVET in their province. The WDA is in charge of developing curricula, standards of assessment and accreditation, quality assurance and partnership with private sector and supporting organisations. They have been supported by PAFP in developing competence-based curricula in priority trades such as agriculture and veterinary science, food processing, tourism and hospitality and civil engineering. In addition, accreditation standards have been developed, and a qualification framework adjusted to those of neighbouring countries has been formulated and validated.

Since PAFP was not the only external support partner to the Rwandan TVET institutions, the authorities have created consultation platforms in which Development Partners and their Rwandan counterpart discuss strategies and operations and in which alignment and harmonisation in line with the Paris Declaration can take place. Each development sector, such as *Education*, has formed a cluster working group, with several sub-cluster working groups, such as the one for TVET. The latter is subdivided into three technical working groups, focusing on TVET delivery systems, on skills development and on TVET standards. PAFP was co-chairing the TVET standards working group and participated as member in the other two.

In this multi-level and multi-institutional systems approach, *competence* is at the core of quality TVET. In the first place, it comes back in curriculum development, whereby competence was defined as a combination of knowledge, skills and attitudes (see also: Le Deist and Winterton 2005) related to specific job characteristics that are demonstrated in professional performance. Competence-based TVET is understood as a structured approach to training and assessment that is directed towards achieving specific learning outcomes. In competence-based TVET, the

outcomes to be achieved are clearly stated in advance so that learners know exactly what they have to be able to do, trainers know what training or learning is to be provided and industries know the skill levels offered by qualified job applicants. The emphasis in CBE is on 'performing' rather than just 'knowing'. In the case of WDA, each job type is divided into overall responsibilities or duties, each of which is subsequently divided into tasks through a process of occupational analysis based on the DACUM method. This method to job/occupational analysis is widely used in North America (Norton 1997) and also applied in Rwanda. This analysis is usually done in meetings representing employers, educators and curriculum specialists. The context of job execution is also made explicit, such as types of enterprise; area of intervention; place of practice; positioning within a company; the type of equipment and materials used and working conditions. This then results in related competency statements that cover a task-related performance, such as 'Maintain health and safety and sustain a good environment in the workplace'. These statements are operationalised into 'indicators' such as 'Storage techniques for perishable goods, such as "first in, first out", are respected'. In the course structure, each competency is translated into a learning unit or module that indicates performance and result criteria, such as 'Food is not contaminated with any body fluids or tobacco product from sneezing, coughing, blowing nose, spitting or smoking'. The learning unit is then described in terms of the learning outcome, the content in terms of knowledge or skills to acquire, the proposed learning activities and the needed resources. Various forms of assessment are proposed.

In order to prepare the schools for delivering competence-based TVET, a provincial structure of in-service master trainers consisting of pedagogical representatives of each pilot school and some representatives of the regional training authorities has been established. These master trainers have been trained during a period of 2 years in fourteen modules developed by PAFP. The master trainers on their turn deliver similar training and accompany colleagues in their respective schools. The fourteen modules cover standards for delivering competence-based training in TVET, addressing four main aspects of competence-based teaching skills:

- Task skills: Instructing and assessing learners so that they are able to perform individual tasks
- Task management skills: Instructing and assessing learners to be able to manage a number of different tasks within the job as to demonstrate a consistent occupational performance
- Contingency management skills: Instructing learners to be able to respond to sudden changes in routine
- Work readiness skills: Instructing and assessing learners to be able to deal with the responsibilities and expectations of the work environment

In addition to competence-based curriculum development and the installation of a competence-oriented teacher training system, pilot schools were intensively coached on implementing the new curricula and stimulated to reflect on their possible improvement. A culture of *action learning* in the class room was enhanced: an adult-learning cycle for teachers identifying curriculum-implementation problems;

trying out improvements within the scope of their abilities and resources available; sharing the results with colleagues and members of a more extensive learning network and documenting knowledge for further dissemination towards 'the upstream'.

Since management of schools is considered a crucial element for the success of TVET reform, an extensive school management and leadership learning programme was implemented. School leaders and their deputies were trained in and coached on matters such as strategic and operational planning; finance and administration; ICT; English language as medium of instruction; designing and maintaining computer-based management information systems; implementing an internship programme for students based on logbooks and industry-based assignments; introducing and managing production units for additional income generation and practice-based learning and the establishment and running of business incubation centres (BIC) to create an experimental environment where demand from clients for products or services are met by graduates, accompanied by tutors from the TVET centre, in a business type of centre. As such, practical entrepreneurship is trained, leading to possible self-employment.

A specific concern was the risk of dispersed activities due to the quantity of subjects and the geographical spread of interventions and the consequent risk for lack of consistency and sustainability. As an exit strategy, PAFP in 2014 started actively supporting a process of accreditation-focused quality improvements of the 24 pilot schools. After further capacitating the relevant departments within WDA and IPRC, schools were jointly visited and audited on the basis of pre-established standards for accreditation of schools, programmes and teachers. The visitations resulted in pre-accreditation plans for capacity building and material investment per school. The plans for acquisition, installation and maintenance of training equipment was based on national Standard TVET Equipment Lists (STEL) for the specific trades and were purchased by PAFP though public tenders. Established capacity gaps were subject to specific training and coaching in the pilot schools via the IPRC structures. As such, the pilot schools were prepared for final accreditation, IPRC was aided in their coordination and capacity building mandate and WDA was supported in its standardising and inspection role. The programme outcome also obtained a very clear and measurable indicator for success: the number of accredited schools. By capacitating the institutions involved in this process, an autonomous process of quality definition, measurement and improvement was enhanced. The underlying assumption is that accredited schools produce more competent and employable graduates, which is verifiable through subsequent tracer studies.

Monitoring and evaluation (M&E) was an important instrument of organisational learning for PAFP. On a weekly basis, the technical staff of PAFP reported on their activities to the M&E officer according to an efficient and result-oriented format. The M&E officer also visited operations in the field in order to test result hypothesis, i.e. the presumed effects of programme activities on aspired results (BMZ 2012, p. 8). Every quarter, a synthesis of these inputs was drafted and discussed in a plenary meeting with technical staff and the partners. As such, the programme-organisation identified obstacles and opportunities that could be addressed by adapting the programme-operations and approaches. This flexibility or

exploratory nature was an important feature of the programme, which in a way turned the programme into a form of action research. The main inquiry for that action research concerned the impact of activities and approaches in the ability of TVET organisation to deliver labour market-responsive, competent alumni. More specifically, this also allowed evaluating the scope of the use of *competence* as an aspired bridge between TVET and the needs of the world of work.

23.3 Noises in the Competence-Development Chain in Rwanda: An Analysis

It is too early to measure in a quantitative manner the presumed impact of increased labour market-relevance due to the introduction of competence-based TVET via the PAFP programme. For this, tracer studies and employer satisfaction surveys over a series of years after graduation from schools that went successfully through the TVET reform would probably be the most appropriate instrument. However, it is possible to make a number of qualitative observations resulting from the innovations introduced in the 24 pilot schools of PAFP over the four project years. Further study of ground literature helps in putting these observations in a theoretical context that permits drawing some conclusions.

The 'competence-development chain' starts with involving the industry in the formulation of competence profiles of the workers they expect to engage or need in the near future. The competence profile consists of a number of competency statements that are the backbone of curriculum documents developed by educational specialists. The curriculum is used by a TVET centre in shaping their education in such a way that the competencies are personalised and reproduced by their learners. These graduates, the laureates, become part of a competent workforce and either find a job or create a business in the respective industry. By planning this in a central way, this stimulates the formal economy in strategic sectors and provides meaningful livelihood to youth, leading to an organised form of socio-economic development.

Figure 23.1 refers to various forms of 'noise' in this competence-development chain in the form of transactional challenges that appeared when putting it in practice in Rwanda. Five categories of challenges representing this noise have been identified and will be further discussed below.

23.3.1 Challenge of Representation

Data about market needs in Rwanda are limited and not always of convincing quality. Since 2012, Rwanda has the so-called Sector Skills Councils (RoR 2014) that are meant to bring together employers and education providers. Some other initiatives that envisage bridging employment needs with educational output exist,

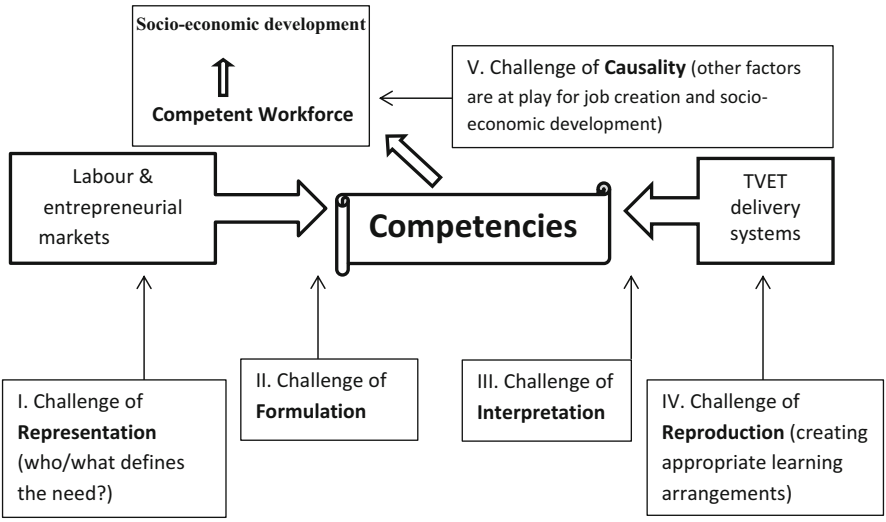

Fig. 23.1 Transactional 'noise' in the competence-development chain in Rwanda

such as the Kigali Employment Service Centre (KESC), but are nevertheless too new (2013) to have a noticeable impact. The best central source of information that could inform the formulation of competency gaps comes probably from the Rwanda Development Board, which manages a labour market information system (LMIS). However, this system is entirely based on secondary data and has few links with the main statistical agency NISR. Data are of a rather general nature and not of much use for specific competency analysis. Another initiative of RDB is conducting the so-called skills surveys, which comes closest to something like a central inventory of competence needs. Skills gaps of existing workforce are identified and quantified (RDB 2012). The general picture is that over 90 % of employed staff needs further training in almost all competencies. Competencies, or in the terminology of the surveys, skills, are however not clearly defined, only alluded to by stating occupations such as Head Maize Reception, Fishery and Aquaculture Labourer or Assistant Tea Maker. The skills gap is then identified by giving numbers about vacancies in specific occupational categories. Certainly one may expect that the organisations that employ these workers do have task descriptions, but these are neither generally validated nor centrally available.

Curriculum developers therefore have to resort to a series of meetings joining a limited number of experts from industry, representatives of TVET institutions, including WDA, and an outside-consultant specialised in the DACUM approach, such as a technical assistant of PAFP. In open sessions, occupational profiles and related competency profiles that form the basis for the curricula are designed. The main question here is whether the experts from industry represent sufficient body to represent 'the demand side' from the world of work. Experts are often identified through personal networks and there is no specific methodology to establish their numbers, qualities or provenance. The validity and reliability of the information provided by the demand side is therefore highly doubtful.

23.3.2 Challenge of Formulation of Competencies

Competencies are formulated as a language-based sequestration of market needs that can be used as a learning outcome for TVET. It is formulated as a statement which generally follows the imaginary phrase of 'The ability to…' and then follows the competence statement starting with an active verb, such as '*…understand oneself as part of a team and respect the rules of the workshop*'. Subsequently, these competencies can be broken down either in sub-competencies, or, in more operational statements, as assessment criteria and standards that permit to evaluate products and performance of learners. As such these language statements suggest representing an achievable quality of universal value for a given sector that can be taught at a TVET centre. Through the social interactions during competence formulation meetings, a variety of participants, each with their own background, try to reach consensus on exact formulations and sequence of texts in curriculum documents (for more background, see also: Mulder 1992). This diversity is seen as an advantage, since it serves bridging the world of work with the world of education, each with its own specific requirements. A competency statement is thus a compromise, which results from negotiation between the more vocal individuals present in a meeting. Other individuals might have come up with a different compromise and consequent competency statement. As will be further described in the last section of this chapter, such a meeting can be considered an *arena* with different types of actors, each with their own 'baggage' influencing their input, determination and perceived importance. This makes that a competency statement is to a certain extent circumstantial and not necessarily reliable. Sitting in these meetings, one notices the presence of people from different language background: Dutch, American-English, Belgian-French, Rwandan with francophone background, Rwandan with Anglophone background and Rwandan who basically only speaks her mother tongue Kinyarwanda (see also: Halsema 2014). There are noticeable different schools of understanding of what competence is, and the more specialised someone is, the more difficult to align. Formulating statements of competence is then a cumbersome process of compromising. This makes also the validity of the statements doubtful. A more systematic and reliable process would be possible (see Mulder 1992), but is for various reasons rarely implemented.

23.3.3 Challenge of Interpretation

On the other side of the linguistic spectrum involved in the formulation of competency statements is proper understanding and interpretation. Curricula, including the competency statements that structure them, are published on the website of WDA and then 'rolled out'. This means as much as teachers and school directors in isolated districts are supposed to download the documents formulated in English and start using them. However, Rwanda faces specific language problems. Simpson (2012) refers to an important factor that exacerbates the language situation in

Rwandan education: the change from French to English as the main medium of instruction (MOI) in 2009. Halsema (2014, p. 13) describes how already in 1996, when the governing party came into power, English was introduced as a third MOI. With time, when Rwanda joined the East African economic Community, English received even higher status. The downside was that this resulted in an important setback for teachers, certain categories of pupils and the availability of appropriate learning materials that was French oriented. This implies that on the receiving side, the formulated competencies may be very difficult to understand or even completely incomprehensible for the end-users. Without appropriate training and coaching, these teachers are not likely to change their syllabi and ultimately the implemented curriculum. The whole mindset in the Rwandan education seems to be contrary to the requirement of competence-based teaching, which makes a correct understanding and interpretation of competence-based curricula extremely difficult.

This is illustrated in Honeyman (2013b, pp. 70–80), who describes in her dissertation how the precolonial Rwandan education was centred around the court of the Tutsi kings in the so-called *itorero*, where preparing for warfare, recital of poems and dance took place. Social mobility was only possible for a few that qualified for entry in the *itotero*, irrespective of their ethnic background since mental and athletic potential was prevailing over ethnicity. Others were kept in a rigorous patron-client system that linked pastoralists with agriculturalists, the so-called *ubuhake*, that established a culture of strict obedience, secrecy and dependency that somehow still characterises the Rwanda of today. When German colonial administration came in at the end of the nineteenth century, these were hardly interested in education. However, the church, and in particular the Catholic church through the *white fathers* order, introduced basic education on a large scale. General education was also new to Europe at the time and thought to be the right thing to do to uplift a people. In particular the masses went to school that previously saw themselves excluded from *itorero* as virtually the only way for social uplifting from their tough lives of subsistence agriculture. However, the curriculum of the catholic schools consisted almost entirely of the catechism, which needed to be rote learned and recited. *Together*, *these poetic and catechism (reproductive*, *WvH) pedagogical styles have created a limited*, *but firmly ingrained*, *repertoire of disposition for teachers and students that continues to shape the entire field of education in Rwanda up to the present day (*Honeyman 2013b, p. 77).

This demonstrates that, even if adequate and sufficient training of teachers and school managers would take place for appropriate interpretation and use of competence-based curricula, the hurdles to be taken in adjacent fields – such as understanding and demonstrating the appropriate mentality and attitude – are so many, that the aspect of correct interpretation of curricula documents creates much ‘noise’ in the competence-development chain.

23.3.4 Challenge of Reproduction

Creating the right learning environment to teach the competencies cited in the new curricula is by far the most daunting element of the competence-development chain. Supposing that the curricula are well interpreted, and that the teacher in question has received the necessary pedagogical training, the magnitude of CBE impacts on almost every element of the educational system. This includes difficult-to-control aspects such as the view from pupils and parents of what constitutes good education. Important training elements such as opportunities for authentic learning in a workplace, meaningful internships, professional assessors and teachers with professional experience, are often lacking. School-based workplaces are very expensive and rapidly outdated. Students have no books or photocopies of learning material, so they spend much time of theoretical classes on copying or memorising the crumbling notes chalked by the teacher on the black-painted wall of a crowded classroom. Business incubation centres, if existent, are mostly empty buildings with some empty desks which is a result of a lack of clients interested in a product or service that a school-coached graduate could provide.

These and other aspects are often articulated by school managers when asked what their most pressing obstacles are for CBE-implementation. However, perhaps the most difficult aspect of change, which occurs with teachers throughout the world, is that teachers are an authority over pupils, and that by letting go this role of knowledgeable expert, they may be seen as losing authority and competence. The aforementioned culture of obedience may also prevent individual teachers to implement elements of the competence-based curricula as soon as someone above them in the hierarchy pronounces different views or takes decisions that are not consistent with it, irrespective if it is out of ignorance or for other reasons. Teachers receive also very low wages that do not relate to those of their professional counterparts in industry. Someone with professional experience who would be able to create situations of cognitive apprenticeship for learners within a specific trade will most likely refuse a job in TVET. The public image of TVET is negative, and, amongst learners, TVET is seen as the last resort. Students in TVET are probably amongst the poorer and weaker, with more limited learning capacities or motivational issues. Poor basic education makes that additional skills development is often inefficient and ineffective. The students in this kind of education do not respond well to student-centred, reflective ways of teaching. So in the end, the excuses are many not to go for change, to stick to old habits and maintain the classical, lecture-based and rote-learning oriented style of TVET that is not able to reproduce the desired competencies described in the new curriculum documents.

23.3.5 Challenge of Causality

Assuming, once arrived at the top of the competence-development chain, that all previous steps were successful, does then competence as predictor of performance of graduates allow new companies to be established and existing business to grow because of an increased competent workforce following massively developed competence-based TVET? Rwanda has a strong economic growth rate of on average 8 % per annum, but this is for an important part driven by demographics and official development assistance (ODA). Some sectors are clearly booming, such as construction, micro, small and medium enterprises (MSMEs) in transport and telecommunication, small holder and cooperative agriculture and also mining is coming up. But where do the 200.000 formal, off-farm jobs have to come from that Rwanda is planning to create annually (RoR 2014, p. 5)? Each year, 125.000 youngsters out of the youth bulge of 18 years and younger (52 % of the population) enter the job market, so the need for those jobs is indisputable. Given the freeze on government jobs, these new jobs need to be created mainly by the private sector. Yet recent surveys (RoR 2014, p. 6) suggest that the Rwandan economy is not creating productive and remunerative jobs fast enough to keep up with demographics. It is notable from discussion with former students how few graduates actually seem to engage in the trade they were prepared for in TVET and how many have diversified approaches in the informal sector being active in various trades in order to make ends meet. Johanson and Adams (2004, pp. 47–51) put this aspect in a wider sub-Saharan African context by stating that real wages have fallen in many countries and wage employment in the modern sector is stagnant. They argue that because of this, the informal sector remains crucial for youth employment in the foreseeable future (it constitutes 85 % of total employment, of which two third in smallholder agriculture). This situation leads to an increase of poverty because of increased competition or crowding-in of low-skilled labour. This vicious circle could be broken by innovation in the informal sector via technical skills development and above all, the development of generic skills such as innovative entrepreneurship, problem-solving and creativity. Yet Rwanda does not encourage the informal sector, or even actively discourages it through regulation and taxation, and encourages a type of *orderly entrepreneur* (Honeyman and Mutimukeye 2013) that mainly has theoretical knowledge about, and not so much skills for, business development.

This argument leads to the question: *Are the right people and the right job-profiles targeted when formulating the competencies for the Rwandan youth of tomorrow?* If not, this would imply that there is an attempt ongoing to meticulously and massively try to engineer a competent workforce that will not be needed in the intended way. Is Rwanda the ‘Singapore of Africa’ as it is aiming for, or just another, relatively promising but nevertheless landlocked, mineral-poor and overpopulated Sub-Saharan African country?

23.3.6 Concluding Remarks Concerning the Competence-Development Chain

Focusing on the sometime resounding noise within the competence-development chain draws away attention from a more positive effect that nevertheless became evident from observations during several years of implementation in pilot schools, from reports and testimonies. Depending on the school and the capacity of the teachers concerned to reflect on and adapt their own educational practices, the new, competence-based curricula are used as a reference to change their syllabi and make their courses more practice oriented. There appears to be an increase in focus on personal performance of learners according to presumed needs of future professions, and a tendency to move away from previous less effective educational practices exists. Testing is more focused on abilities and problem-solving and less on reproducing memorised texts or protocols. These observations suggest that competence development, although perhaps not in the intended mechanical way, offers opportunities for reducing the gap between education and the world of work.

23.4 Conclusions

From the above analysis of the competence-development chain, it can be concluded that within the context of sub-Saharan Africa in general, and Rwanda in particular, there are important transactional trade-offs and costs:

- It is difficult to establish objectively what the exact need for jobs is; projecting ambitious targets of economic growth in strategic sectors may not be a reliable basis for massive, centrally controlled and very specific competence development.
- Under the circumstances it is difficult to formulate exact and understandable statements of competence that could guide large-scale programme development for specific jobs.
- For the foreseeable future, the apparatus to carry out the intended TVET-reform policy does not have the potential to live up to expectations.
- The professional learning that is envisaged or realised does not equip graduates appropriately to engage in innovative economic activity if they do not manage to enter the formal market of waged employment, which may be the case for a vast majority of graduates.

The measures that would be needed to reduce ‘noise’ in the system will be very expensive and time-consuming, and still their outcome would be highly uncertain. Therefore, competence as ‘bridge’ between the world of work and TVET through detailed task analysis of jobs, central planning of competence through national curriculum development and massive rolling-out over the nation’s TVET centres may just

be a bridge too far. However, there are sufficient encouraging signs of the usefulness of introducing an outcome-based pedagogical approach in TVET schools. The concept of 'competence' may be a useful vehicle to prioritise learning-content by a trainer, encourage new styles of teaching and testing, give more voice to students in their learning process and extend the school as space for learning more to the world of work and its professional practice.

Several questions remain. If competence is to play a meaningful role for TVET in sub-Saharan Africa, how should its definition adapt from the current behaviouristic understanding in order to make it more useful and practicable? And how can it better connect to the kind of professional learning that is supposed to take place for economic innovation? And how could the authorities better plan and regulate this?

In an attempt to angle discussion about these questions, it may be useful to first elaborate more on the notion of *competence* and the behaviouristic understanding of it. Benoist and Gibbons (1980) argue that competence-based training (CBT) and behavioural objectives of learning are two different concepts that are often wrongly associated or even erroneously mixed together: CBT (or CBE) by itself is not necessarily an expression of a behaviourist philosophy of education, whereas the assessment of predefined outcomes of (cognitive and physical) behaviour intrinsically is. By setting predefined outcomes, a reductionist view on reality is introduced; hence the envisaged learning is also limited. It therefore may impede engaging in an innovative manner when facing unpredictable professional situations. Wals (2005, p. 121) refers to the process of the disciplinary organisation of knowledge. This disciplinary organisation of knowledge (for TVET the subdivision in trades and teaching subjects could be a manifestation of that) penetrates learning institutions and through it contemporary society as a whole. Honeyman (2013a, b, p. 73) alludes to this when describing the 'disciplinary state' (Foucault) leading to a formal system of credentials in education that do not necessarily represent competence as defined in this chapter. The simplification serves to create a model of concreteness which allows concrete action and technology, or straightforward management models. However, it is often forgotten that this reductionist view is still a model: this 'forgetting' tends to turn it into reality by ignoring all aspects that do not fit in the preconceived models. Without disputing the usefulness of this kind of reductionist models, learning for innovation should create the ability to think 'out of the box' of these models and review reality in new terms.

Competence-based training (and education) is often seen in perspective of a constructivist approach to learning and more so in its social sense of taking place in group dynamics and through language and images (see Kibwika 2006, pp. 31–33). This implies that a learner actively constructs knowledge and skills based on his own world of reference. This is done on the basis of reflexivity and social interaction within a learning environment, hence the focus on student-centred learning approaches. A useful image is proposed Pierre Bourdieu (Grendfell and James 1998, pp. 6–26), arguing that through reflexive interaction, individual *agents* can intervene in a *champ* or *field* (p. 24) that represent an identifiable network of interconnecting relations, each with its own logic and hierarchy. The ability to be effective in such a field is determined by different forms of *symbolic capital* as

manifestations of power or influence. Bourdieu states three sorts of capital: economic capital, cultural capital (including skills and knowledge) and social capital. This capital is mostly used in an unconscious way in a 'market-game' of supply and demand (p. 20). TVET under the competence-based approach can be considered such a field which structures can shape a learner's '*sens pratique*' for the profession. This notion of 'reflexive objectivity' that in potential can restructure underlying structures is eventually marked as 'structural constructivism' (Bourdieu 1989, p. 14), whereby the reproduction of human activity takes places as a dynamic process in ever-changing contexts … through a synthesis between objective and subjective views of a phenomenon (p. 19). This allows for insights and the ability to react professionally to unpredictable situations in an unique way, allowing for a number of possible and original 'moves' based on a personal view on 'self', 'choice' and 'action'.

Wals (2005, p. 118), without disputing the importance of different forms of learning, suggest a shift in focus from propositional 'learning for knowing' (savoir) on the basis of subject disciplines and the more practical 'learning for doing' (savoir-faire) towards the more experiential 'learning for being' (savoir-être) (see also Le Deist and Winterton 2005 and the chapter of Le Deist in this volume). By being an (aspiring) specialist in a given technical field, one uses skills and knowledge in constantly varying patterns according to new challenges in the changing context. Learning in CBE is therefore not necessarily based on a simplification of reality and a subsequent reduction of learning based on a representation of that simplified reality but can also be meaningfully guided by a tangible and measurable yet imperfect system, linking learning in a more general sense to the needs of the markets. Any CBE, in this vision, should recognise that learning is much more holistic and complex and the outcome much more diverse than could be preconceived and measured on the basis of a few criteria linked to a written statement of competence. This reminds of the iceberg model (Lyle, Spencer and Spencer 1993), whereby the behavioural aspects of knowledge, skills and attitude are visible and transferable, whereas many other aspects underlying performance, such as self-concept, traits, tacit learning and motivation, are hidden under the surface. Bourdieu refers to this phenomenon as *habitus* which can be influenced by an *agent* through reflexivity. Competence viewed in this perspective can therefore only *partly* be influenced through education, for instance, the element of motivation or self-concept. In, as an example, Germany, working on the professional identity is part of the CBE approach. However, other aspects of habitus such as traits, values or motives may be a result of previously established experiences or characteristics of a learner.

After the phase of industrialisation, South Korea went through a process of democratisation and globalisation, obliging the country to open up and focus more on skills as creativity, flexibility and individualism as elements of the capacity to respond to global market opportunities with limited predictability. This requires a different way of learning and teaching, as is demonstrated above. The transition from a developmental state with centralistic characteristics to a more neo-liberal state with devolution of power and responsibility to local levels of administration was crucial to that process. Honeyman (2013a, b) refers to this as a transition

towards the *post-developmental state*. The example of Singapore is often cited as successfully combining the elements of state-control and *laisser-faire*, favouring individual liberty, innovative entrepreneurship and creativity at decentralised level. For many emerging economies in sub-Saharan Africa this poses serious internal contradictions to their educational systems. In this view the role of the state is not that of central planning of and control over a precise outcome of TVET but one of providing an enabling environment for partly unplanned competence development at decentralised level. TVET governance should thereby take place through more self-regulation; the state should formulate *security policies* to assure that natural processes in the field of TVET can take place and resort less to the usual *disciplinary technology* of central management (Foucault, in Honeyman 2013a, b, p. 14). Concretely, in this logic, a national authority like WDA should entirely focus on setting general standards and regulate private and public TVET centres through a system of visitation and accreditation, instead of the current blurred mandate to both regulate and implement TVET. National standards should not consist of narrowly defined professional competencies, but of more generic level descriptors, which allows TVET centres to fill in these standards in their own, unique way, nevertheless within quality- and level-boundaries. National control is not relinquished in this way but rather shifted towards a focus on self-rule and self-reliance within a government-sanctioned framework.

To finalise this discussion, the spotlight should return to *competence* as a possible bridge between school and work: does the above entail that government should let go its ambition to develop specific strategic economic sectors through competence development? And on what competencies should individual TVET centres then focus? Current discourse such as conducted by the World Bank (Filmer et al. 2014) proposes to shift attention from development of the formal economy and projected job markets to a broader concept of *Youth Development* for sub-Saharan Africa. This implies aiming for both competencies needed in formal and informal employment. Examples of this include sectors such as small holders' agriculture, household enterprises and the modern sector wage jobs (pp. 11–23). Government could centrally focus on the crucial foundational skills of basic education, such as basic cognitive skills; behavioural skills; and socio-emotional skills. In addition, private and public TVET institutions should be enabled to provide more portable competencies. These could be focused on, for example, productivity improvement of smallholders' agriculture through processing, marketing, improved machinery operation and repair, transport facilitation, improved logistics and through quality control (p. 14). Entrepreneurial learning could be reinforced for household enterprises through technical training in a specific sector such as carpentry, business development and financial literacy, behavioural and life-skills (p. 18). For the modern-sectors wage-jobs, usually a higher, yet profession-oriented and competence-based

learning is required combined with creative and entrepreneurial skills.

Most important, however, is that these skills gaps are not taught as subject matter but experimented by learners in fields of interaction with peers, tutors and the professional world, so that competence will develop as an integrated ability to act

innovatively and technically sound to professional issues, or as an enhancement of the learners as an entrepreneurial-self with an intrinsic drive to recognise and use opportunities.

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Part III
Competence and Key Aspects of Education Systems

Chapter 24
Competencies in Higher Education: Experience with the Academic Competences and Quality Assurance (ACQA) Framework

Jacob Perrenet, Tijn Borghuis, Anthonie Meijers, and Kees van Overveld

24.1 Introduction

As Mulder and Winterton point out in the introduction of this volume, practical applications as well as the theoretical foundation of competence-based education have been under discussion for some time. This might be one of the reasons that its adoption and implementation has been slower in academic education than in vocational and professional education. In merely one programme at Eindhoven, Industrial Design, the competence perspective is a central paradigm. For most other programmes, competence thinking mainly entered the educational system for the purpose of quality assurance and accreditation. The set of Criteria for Academic Bachelor's and Master's Curricula ('the Criteria') was developed in the years 2002–2005. Initially, the term 'competence' was not even used explicitly until later, as the Criteria developed into the framework of Academic Competences and Quality Assurance (ACQA). At that time, the concept of competence or set of competencies has been incorporated as an integration of knowledge, skills and attitude.

The set of criteria developed into a framework of learning outcomes, as an alternative to the more global Dublin Descriptors (DD), developed by the Joint Quality Initiative (JQI) working group (JQI 2004). The framework was based on interviews with prominent researchers and designers from the TU/e (Meijers and Van Overveld 2002) and was partly inspired by a list of academic competencies constructed by a government educational advisory committee (Franssen Committee 2001). Reasons to develop an alternative framework were the need for a detailed description of competencies and the need for a differentiation between academic and professional education and to include design competencies, characteristic for technology education.

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The ACQA framework contains seven competence areas and four dimensions of academic thinking and acting. The competence areas are *disciplinary competence*, *doing research*, *designing*, *scientific approach*, *basic intellectual skills*, *co-operating and communicating* and *temporal and social context*. The dimensions of academic thinking and acting are *analysing*, *synthesising*, *abstracting* and *concretising*. Every competence area contains five to eight competencies, formulated at bachelors' and master's level in a discipline-neutral fashion. For every dimension a series of discipline-dependent levels has been constructed according to a general principle and aiming at covering all levels of the discipline that these levels belong to. This dual framework and its applications will be the subject of this chapter.

In the following pages we will sketch ACQA's reasons for development, we will briefly compare the framework with some other well-known frameworks, and we explain its details and its main application using a standard procedure for measurement of a curriculum. In this main application we refer to the so-called perceived curriculum, the curriculum as interpreted by the teachers (Van den Akker 2005). Using Van den Akker's analysis of curriculum perspectives, we will also show some applications of the ACQA framework in other perspectives, e.g. as envisaged by the management or as a set of student learning results.

Some research has been done on the quality of the framework; the results will be summarised. The ACQA framework has been accepted and applied at several other universities in the Netherlands as well as in other counties. These applications will also be summarised. In the conclusion and discussion section, we will reflect on what has been realised from the initial ambitions and speculate about future developments.

24.2 ACQA's Seven Competence Areas and Its Background

We describe the historical background of the development of the ACQA framework using the exposé of Meijers (2006). The Bologna Declaration (European Ministers of Education 1999) committed the member states of the European Community to strive for more transparency in higher education. It aimed at the harmonisation of the various cycles in education and at degrees that can be more easily interpreted. The aim of this restructuring was, among other things, to increase mobility in higher education within the European Union. By now, many EU member states have implemented a bachelor-master structure. To allow for smooth connections between subsequent cycles, explicit learning outcomes or end qualifications of students for the first (bachelor) and second (master) cycle are essential. These learning outcomes have become even more important now that quality assurance and accreditation systems have been based on them.

Under the auspices of the European Community, a system of learning outcomes has been developed under the name of Dublin Descriptors (DD) by the Joint Quality Initiative working group. It consists of five competencies, defined at both the bachelor's and the master's level. The competencies concern (JQI 2004):

1. Knowledge and insight
2. Application of knowledge and insight
3. Formation of a judgment
4. Communication
5. Learning skills

As an example, we give the descriptors for the bachelor's level ('first cycle' in terms of the DD).

The students should:

1. Have demonstrated knowledge and understanding in a field of study that builds upon and supersedes their general secondary education and is typically at a level that includes some aspects that are at the forefront of their field of study
2. Be able to apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation
3. Have the ability to gather and interpret relevant data to inform judgments that include reflection on relevant social, scientific or ethical issues
4. Be able to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
5. Have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy

In the Netherlands and in Flanders, Belgium, these descriptors are used in the new accreditation system that followed the implementation of the bachelor-master structure. The management of every programme had to prove (by content-related characteristics) that the level of education is really academic. 'Academic' is no longer the defining predicate for university education.

Although broadly accepted in Europe, the DD have some limitations:

- The identified learning outcomes are very general; they do not have much operational value.
- They do not discriminate between academic and higher vocational qualifications.
- They do not include design as an engineering activity.

An extension of the DD system has been adopted by the European Committee (EC), the European Qualifications Framework (EQF); see EC (2008). However, the criticism of the DD carries over to the EQF, according to Meijers (2006). There are several international organisations with quality assurance-related activities. Close to DD and EQF, the International University Network of the Tuning Project has developed a more subject-specific system (Gonzalez and Wagenaar 2003, 2005). This system goes further in operational detail than the DD and EQF, but still discrimination between scientific and vocational qualifications as well as recognition for design as an engineering activity is underexposed. The Accreditation Board for Engineering and Technology (ABET) is a long-standing American organisation for accreditation in applied science, computing, engineering and technology; see ABET (2011). The Conceive, Design, Implement, and Operate (CDIO) initiative is a more

recent, international initiative for curricular planning and outcome-based assessment in engineering schools (Berggren et al. 2003). Both only focus on higher technical education; general university programmes are beyond their scope. All the systems mentioned above share a level of distinction that is rather rough, and measurement is mainly based on perceptions of those involved.

The Criteria for Academic Bachelor's and Master's Curricula were developed to overcome these limitations. Its scope was academic education in a broad sense. The Criteria were accepted by the Dutch-Flemish Accreditation Organisation (NVAO) as an alternative for quality standards to accredit curricula from the field of technology. The following seven areas of competence were formulated (Meijers et al. 2005).

The university graduate:

1. *Is competent in one or more scientific disciplines*: A university graduate is familiar with existing scientific knowledge, and has the competence to increase and develop this through study.
2. *Is competent in doing research*: A university graduate has the competence to acquire new scientific knowledge through research. For this purpose, research means: the development of new knowledge and new insights in a purposeful and methodical way.
3. *Is competent in designing*: As well as carrying out research, many university graduates will also design. Designing is a synthetic activity aimed at the realisation of new or modified artefacts or systems, with the intention of creating value in accordance with predefined requirements and desires (e.g. mobility, health).
4. *Has a scientific approach*: A university graduate has a systematic approach characterised by the development and use of theories, models and coherent interpretations, has a critical attitude, and has insight into the nature of science and technology.
5. *Possesses basic intellectual skills*: A university graduate is competent in reasoning, reflecting, and forming a judgment. These are skills which are learned or sharpened in the context of a discipline, and which are generically applicable from then on.
6. *Is competent in co-operating and communicating*: A university graduate has the competence of being able to work with and for others. This requires not only adequate interaction, a sense of responsibility, and leadership, but also good communication with colleagues and non-colleagues. He or she is also able to participate in a scientific or public debate.
7. *Takes into account the temporal and the social context*: Science and technology are not isolated and always have a temporal and social context. Beliefs and methods have their origins; decisions have social consequences in time. A university graduate is aware of this, and has the competence to integrate these insights into his or her scientific work.

The competence areas can also be mapped out as in Fig. 24.1

Every competence area contains five to eight key competencies, formulated in a discipline-neutral way. In Table 24.1 we present one competency example from

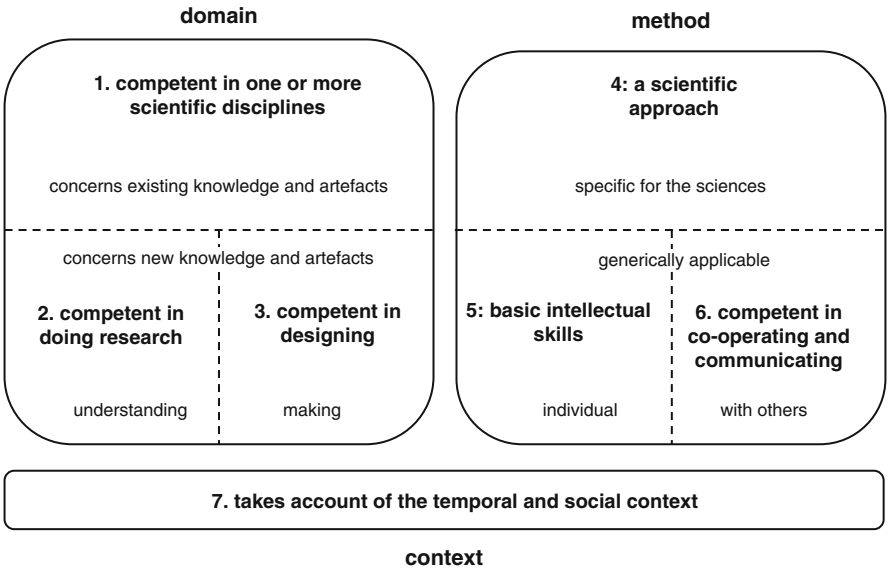


Fig. 24.1 ACQA's areas of competence

every competence area. For area 3, *designing*, often underexposed in general systems, all competencies are listed. Note that the characters k, s and a (knowledge, skill and attitude) refer to those aspects of the specific competency that should be judged as most important. Also skills are almost always combined with knowledge for university graduates.

Table 24.1 only shows competencies required for the bachelor's degree. For the master's degree, a higher level is defined. Various theories which differentiate educational level exist, e.g. the taxonomy of educational objectives of Bloom (Bloom et al. 1956) and the Structure of Observed Learning Outcome (SOLO) taxonomy of Biggs and Collis (1982). Bloom defined levels of handling information: reproduction of information, understanding of information, using information for the solution of problems, seeing patterns in information, generating new ideas from information (synthesis) and evaluating information. Biggs and Collins defined levels of complexity concerning content relations in student responses: pre-structural (not topic related), uni-structural (one issue), multi-structural (disorganised collection), relational (understanding and integrating) and extended abstraction (principle related and beyond). Still other systems use level of complexity of problems or intensity of supervision. We used these kinds of level characteristics to define the master's level competencies for all disciplines. The master's competencies should be interpreted as an extension of the bachelor's competencies. Also master's competencies mostly have an attitude aspect (denoted by 'a'). It is not sufficient for a master to know or to be able to do something – he or she must also have the attitude to use that knowledge or skill in relevant situations (Meijers et al. 2005) (Table 24.2).

Table 24.1 Examples of competencies

Area 1: competent in one or more scientific disciplines	Has knowledge of and some skill in the way in which experiments, gathering of data and simulations take place in the relevant fields [ks] … (7 further competencies in this area)
Area 2: competent in doing research	Is observant, and has the creativity and the capacity to discover in apparently trivial matters certain connections and new viewpoints [ksa] … (7 further competencies in this area)
Area 3: competent in designing	Is able to reformulate ill-structured design problems. Also takes into account the system boundaries in this. Is able to defend this new interpretation against the parties involved [ksa] Has creativity and synthetic skills with respect to design problems [ksa] Is able (with supervision) to produce and execute a design plan [ks] Is able to work at different levels of abstraction including the system level [ks] Understands, where necessary, the importance of other disciplines (interdisciplinarity) [ks] Is aware of the changeability of the design process through external circumstances or advancing insight [ka] Is able to integrate existing knowledge into a design [ks] Has the skill to make design decisions, and to justify and evaluate these in a systematic manner [ks]
Area 4: a scientific approach	Has insight into the nature of science and technology (purpose, methods, differences and similarities between scientific fields, nature of laws, theories, explanations, role of the experiment, objectivity, etc.) [k] … (5 further competencies in this area)
Area 5: basic intellectual skills	Is able to reason logically within the field and beyond; both 'why' and 'what if' reasoning [ks] … (6 further competencies in this area)
Area 6: competent in co-operating and communicating	Is able to perform project-based work: is pragmatic and has a sense of responsibility; is able to deal with limited sources; is able to deal with risks; is able to compromise [ksa] … (7 further competencies in this area)
Area 7: takes into account the temporal and social context	Is able to analyse and to discuss the ethical and the normative aspects of the consequences and assumptions of scientific thinking and acting with colleagues and non-colleagues (both in research and in designing) [ks] … (4 further competencies in this area)

(*k* knowledge, *s* skill, *a* attitude)

A discipline-neutral formulation of competencies allows a unified vocabulary to discuss all programmes. However, a framework for scientific competencies should do more than differentiate between master's and bachelor's level. Firstly, it should account for the different ways of scientific thinking and acting: it is not one-dimensional. Secondly, different disciplines possess different essential characteristics in their acting and thinking, which are lost when generalised. Therefore, we extended our framework with four dimensions of thinking and acting and discipline-specific levels.

Table 24.2 Examples of master's level competencies compared to bachelor's level competencies

Area	Bachelor's competencies	Master's competencies
1	Has knowledge of and some skill in the way in which experiments, gathering of data and simulations take place in the relevant fields [ks]	Has the skill and the attitude to apply these methods independently in the context of more advanced ideas or applications [ksa]
2	Is observant and has the creativity and the capacity to discover in apparently trivial matters certain connections and new viewpoints [ksa]	Idem, and is able to put these viewpoints into practice for new applications [ksa]
3	Is able to reformulate ill-structured design problems. Also takes into account the system boundaries in this. Is able to defend this new interpretation against the parties involved [ksa]	Idem, for design problems of a more complex nature [ksa]
	Has the skill to take design decisions, and to justify and evaluate these in a systematic manner [ks]	Idem, for design problems of a more complex nature [ksa]

24.3 ACQA's Four Dimensions of Academic Thinking and Acting

Interviews with a series of prominent researchers and designers of TU/e revealed four dimensions in academic thinking and acting (Meijers and Van Overveld 2002). The four dimensions of academic acting and thinking are defined as follows (Meijers et al. 2005):

(a) *Analysing* is the unravelling of phenomena, systems or problems into subphenomena, subsystems or subproblems with a certain intention. The greater the number of elements involved, or the less clear it is what the elements of the resulting analysis are, the more complex the analysis.
(b) *Synthesising* is the combining of elements into a coherent structure which serves a certain purpose. That result can be an artefact, but also a theory, interpretation or model. The greater the number of elements involved, or the more closely knit the resulting structure, the more complex the synthesis.
(c) *Abstracting* is the bringing to a higher aggregation level of a viewpoint (statement, model, theory) through which it can be made applicable to more cases. The higher the aggregation level, the more abstract the viewpoint.
(d) *Concretising* is the application of a general viewpoint to a case or situation at hand. The more aspects of a situation are involved, the more concrete the viewpoint.

Characteristic of the activities of the four selected dimensions is that, in the context of science, it is possible and customary to carry out these activities repeatedly and, in doing so, to continue building on the results of the previous step. For example, the outcome of an analysis often makes up the material for a subsequent analysis. Because implementation of the activity becomes increasingly complex with each

1. 1.1 *Description of the starting point*
1.2 *Description of the activity*
2. 2.1 *Description of the starting point (≈result 1.2)*
2.2 *Description of the activity*
3. 3.1 *Starting point (≈result 2.2)*
3.2 *Description of the activity*
…

Fig. 24.2 General construction principle of ladders

successive step, levels in dimensions can be distinguished by the number of repetitions. For a given activity, these levels are made visible in the form of a ladder of examples: by repeatedly applying an activity to a core subject from the field of study and constantly describing the result of the activity, a well-ordered series of level descriptions is created. These examples follow each other like the rungs of a ladder, each of which is characteristic of a particular level of analysing, synthesising, abstracting or concretising in the field. The following is a diagram of such a ladder.

In Fig. 24.2, the first three levels are specified, but the number of levels of the ladder (how often the activity can be repeated, where 'activity' is either abstracting, concretising, analysing or synthesising) depends on the discipline. The ladder covers the entire scope of the field with regard to one dimension: from basic level to state of the art. In this respect, each discipline has its own characteristics and therefore its own number of levels in each of the four dimensions. With regard to one discipline, the ladders of examples for analysing, synthesising, abstracting or concretising may therefore have a different number of levels (Meijers et al. 2005; Borghuis et al. 2010).

In Annex I and II, examples are shown for the disciplines of computer science and applied physics. In the next section we describe and illustrate ACQA's main application, characterising a programme using a standard protocol.

24.4 Assessment of an ACQA Profile in the Context of Quality Assurance

We begin by taking a closer look at the process of implementing a programme or, more generally speaking, a curriculum. When a curriculum is implemented, it transforms. Roughly speaking, the education management team plans the set of competencies (1. the intended curriculum), the academic staff teaches them (2. the implemented curriculum) and the students learn them (3. the attained curriculum). Van den Akker (2005), based on Goodlad et al. (1979) which first proposed these levels, uses a more refined typology:

1a. The ideal vision (rationale or basic philosophy underlying a curriculum)
1b. The formal/written curriculum (intentions as specified in curriculum documents and/or materials)

2a. The perceived curriculum (the curriculum as interpreted by its users, especially the teachers)
2b. The operational curriculum (the actual process of teaching and learning, curriculum in action)
3a. The experiential curriculum (the learning experiences as perceived by learners)
3b. The learned curriculum (the resulting learning outcomes of learners)

In this section we describe the measurement of the competencies with ACQA in the *perceived* curriculum perspective, i.e. the curriculum as interpreted by the teachers. We describe our standardised method, based on teacher interviews. As we will show, this leads to a so-called profile.

To determine a perceived curriculum profile, all teachers with end responsibility for the mandatory courses are interviewed; for elective courses a representative sample is chosen. The first main question asked is: *Which of the seven competence areas are relevant in your course, and how are the students expected to divide their time over these relevant areas?* A time division in percentages is asked. Next, the teacher is asked to indicate, which competencies from the relevant areas are addressed and/or assessed and at what level (BSc's or MSc's). The second main question asked is: *Which of the four dimensions are relevant in the course?* And for each relevant dimension is: *Which levels are addressed and how should the students divide their time between these levels?* Profiles for the curriculum as a whole, or parts of it, are constructed by accumulating the findings for all courses, resulting in radar plots, bar charts and tables, and reported in great detail to the curriculum management team. In the years 2005–2010, almost all bachelor's and master's programmes of the TU/e have been measured by this method, analysing per programme all mandatory courses and a sample of the elective courses. Generally, the results have been gratefully used for quality assurance and in self-study reports for accreditation.

24.4.1 Examples of Results as Reported

Figure 24.3 gives an example of a profile radar plot. The numbers refer to European Credits (ECs); one EC equals 28 h of study load in the European Credit Transfer and Accumulation System. The example shows that all seven areas are addressed. Most ECs are spent on *competent in one or more scientific disciplines*, followed by *has basic intellectual skills* and *has a scientific approach*. Fewer ECs are spent on *competent in doing research* and *competent in co-operating and communicating*, the least on *competent in designing* and *takes into account the temporal and the social context*.

Figure 24.4 shows a typical page of a report containing the information about one of the seven competence areas for a given programme. The radar plot represents the weight of the various competencies in competence area *designing*, calculated as

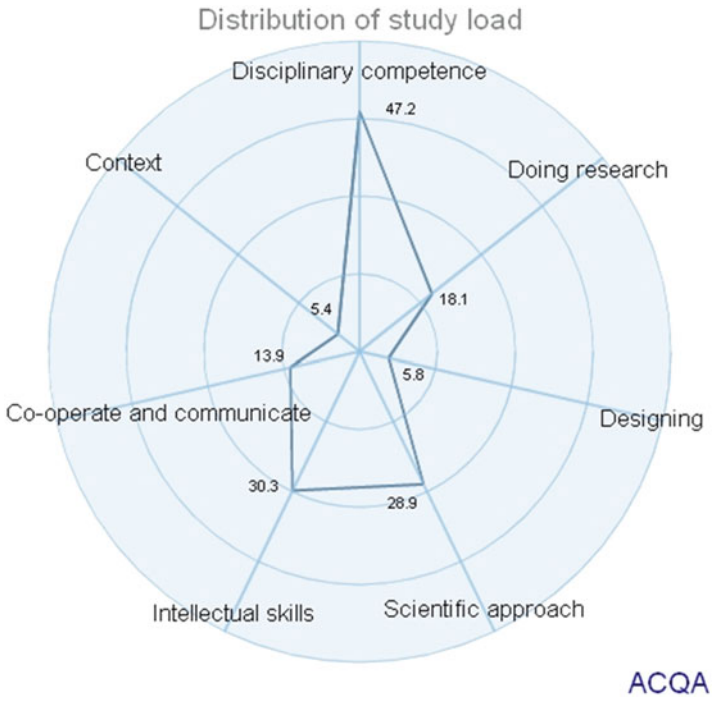


Fig. 24.3 Example profile: division of study load in ECs over the seven areas of competence

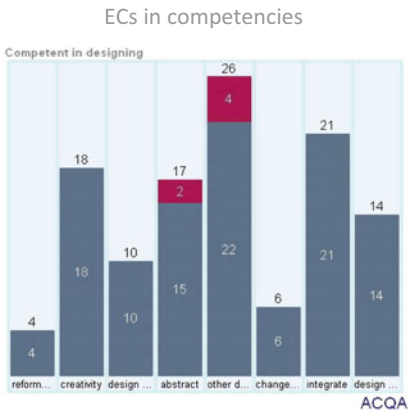
the sum of the study load of all the courses in the bachelor's programme in which that competency is addressed. As we can see in this curriculum, all competencies are addressed. The terms *reformulate*, *creativity*, *design plan*, *abstract*, *other disciplines*, *changeability*, *integrate* and *design decisions* refer to the eight design competencies (see Table 24.1, area 3).

Notice that relatively little study load (<10 ECs involved) is devoted to the following designing competencies: *reformulate* and *changeability.*

The histogram gives extra information about the addressed level. We can observe that two design competencies are addressed at MSc's level: *abstract* and *other disciplines*. The table presents additional information about assessment: the last two columns show the number of courses in which the various design competencies are assessed, subdivided into bachelor's and master's level. We can observe that all designing competencies are assessed. Most designing competencies are assessed only at BSc's level; *abstract* is also assessed at MSc's level.

An example of a result on dimensions is given in Fig. 24.5. For a given programme, in the left-side histogram, the distribution of time spent by students (as intended by the teachers) over the levels of the dimension *concrete* is given. In this case four levels had been defined. Clearly in this programme, all levels are addressed, but mostly level 1. In the right-side histogram, we see a so-called 'span' distribution for the same dimension. *Span* is defined as the number of levels addressed in the

Division of study load (in ECs involved) over the competencies distinguished.



Study load division (in ECs involved) over the competencies, BSc's and(on top) MSc's level.

BSc XXX	number of contributing courses		number of ECs involved		number of courses in which competency is assessed	
Competent in designing	**BSc's level**	**MSc's level**	**BSc's level**	**MSc's level**	**BSc's level**	**MSc's level**
reformulate	1	0	4	0	1	0
creativity	5	0	18	0	5	0
design plan	3	0	10	0	2	0
abstract	4	1	15	2	3	1
other disciplines	7	1	22	4	1	0
changeability	2	0	6	0	1	0
integrate	6	0	21	0	5	0
design decisions	4	0	14	0	2	0

Outline of contribution to individual competencies in numbers of courses and ECs involved

Fig. 24.4 Typical example of a page of an ACQA profile report (section on *design* competencies)

same course. From the histogram we may conclude that for almost 40 % of this programme, the dimension *concrete* is not relevant (span 0). At the other hand, for nearly 15 % of the programme, students go through all the levels.

24.4.2 Use of the Results for Quality Assurance and Advice

Measurement results are typically used by programme managers to compare the profile of the *perceived curriculum* with the *ideal vision* and the *formal/written curriculum*. Discussions about the results often are organised at so-called education days

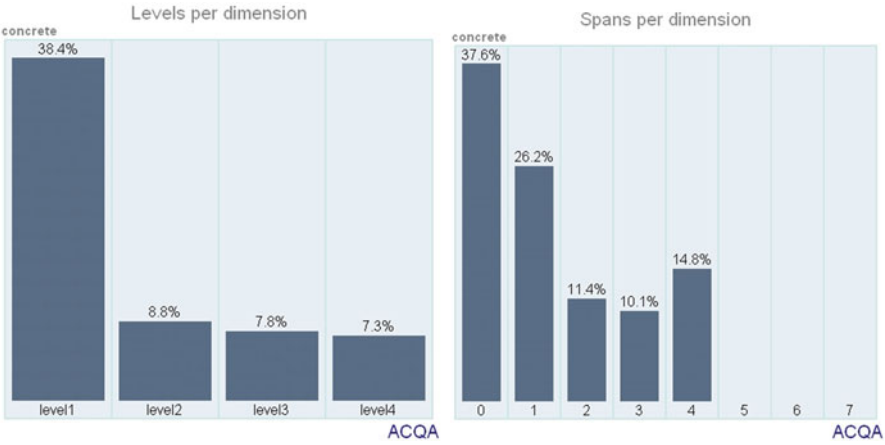


Fig. 24.5 Example histograms with time distribution over levels and time distribution over spans

(periodical gatherings of all involved in a departmental teaching process). Regularly, a programme management team comes up with questions about specific competencies, specific dimensions or specific subprogrammes, asking for further analysis and discussion. We will give two examples (from Perrenet 2009).

Case 1: How to increase attention for research competencies in the computer science BSc's programme

Various parties, such as the visitation committee (by means of the accreditation report) and the BSc students (by means of a survey), asked to give more attention for research competencies. This led to the question of how to increase the attention for competence area 2 without restructuring the curriculum by introducing an extra course on research.

The programme of computer science offers courses with lectures and lab sessions as well as group projects. The content of the curriculum was analysed from two perspectives. First, given the objectives and content of the current projects, what possibilities exist to increase attention for research competencies? Second, given the research competencies, what courses or subjects offer opportunities to pay more attention to those competencies? This exercise resulted in about 30 suggestions. In Table 24.3 some examples are described. In the follow-up, the educational director discussed the suggestions with the specific teachers, and many suggestions were implemented. After a few years, the accreditation commission as well as the students showed more satisfaction concerning that aspect.

Case 2: The academic contribution of the Mathematical Modelling Track in the applied mathematics BSc's curriculum

The Mathematical Modelling Track consists of a series of modelling projects within the Bachelor of Science in Applied Mathematics curriculum. In mathematical

Table 24.3 Example suggestions to increase the attention for research competencies in computer science

Competency	Course	Suggestion
Is able to reformulate ill-structured research problems. Also takes into account the system boundaries in this Is able to defend this new interpretation against the parties involved	Project about information systems: The students receive a hospital information system; it should be improved to meet all information needs	Add an extra question for the students: 'Is there an opportunity to improve efficiency in the hospital's business process'? The students should reformulate this question, e.g. they should construct a definition for efficiency, inventorise what information about the business process would be necessary to answer the formulated question, and if so, in what way the information system should be extended to collect this information
Understands, when necessary, the importance of other disciplines (interdisciplinarity)	Course about human-machine interaction: The students learn to develop user interfaces that are ergonomically justifiable, efficient and effective when used and satisfy certain requirements for the client	Give the students an assignment involving the need for data from psychology, i.e. perception theory (e.g. characteristics of the human visual system or characteristics of the human memory system)

modelling projects, students learn how to apply their knowledge to solve mathematical problems posed in non-mathematical language, as well as how to actively look for, or even construct mathematical knowledge useful for the problem at hand. A part of the staff in the mathematics department has a critical opinion about the level of these projects. To meet this criticism, the programme director asked for an analysis of the Modelling Track in comparison to the complementing part of the curriculum (for short, the subject courses). The goal of the analysis was to answer the question: Are there certain academic characteristics that are typical of the Modelling Track compared to the subject courses? The analysis, using the ACQA framework, showed that the Modelling Track was much stronger on the design competencies than the subject courses. In the Modelling Track students had to spend relatively more time to area 3 (*designing*), and only in the Modelling Track, some design competencies were addressed and assessed at MSc's level. The subject courses had much more emphasis on competence area 1 (*disciplinary knowledge*). As the dimensions and their levels are concerned, the Modelling Track, on average, had a higher level of *concretising* and *synthesising*; the subject courses, on average, had a higher level of *abstracting*. Concerning span (the number of levels of a certain dimension, addressed within the same course) the results showed that the Modelling Track, on average, had a greater span for *analysing* and *synthesising*, while the subject courses,

Table 24.4 Profiles from the TU/e educational philosophy

	% Study load		
Areas of competence	Common minimum	Research profile	Design profile
1 Disciplinary competence	25	35	25
2 Doing research	10	15	10
3 Designing	5	5	20
4 Scientific approach	10	17,5	10
5 Basic intellectual skills	10	17,5	10
6 Co-operate and communicate	5	5	15
7 Context	5	5	10

on average, had a greater span for *abstracting* and *concretising*. The main conclusion was that the Modelling Track substantially contributed to the academic profile (for details, see Perrenet and Adan 2010).

24.4.3 Descriptive or Prescriptive Use

Apart from the comparison of the perceived curriculum profile with the ideal and formal/written curriculum, the results have also been regularly used for normative assessment. The designers of the ACQA framework formulated the following requirements for a programme to be academic. All competence areas have a minimal presence of 5 % of the EC's total and all are present in more than one course. Furthermore, for all four dimensions the maximal level is present in more than one course.

The board of the university used the ACQA framework to define two kinds of BSc programme profiles, a *research* profile and *design* profile, expressed as distributions of study load over the seven areas of competence; see Table 24.4 (adapted from Onderwijsvisie 2008). The two profiles have a common minimum, listed in the second column of the table. This common minimum should be interpreted as a global guideline for all programmes.

24.5 Further Applications of the ACQA Framework

In this section we describe several further applications. The application in Case 3 is not targeted at any specific programme, but it is an evaluation of a university-wide educational innovation, i.e. design-based learning (DBL). In Case 4 specific programmes are compared from the *learned curriculum* perspective: the data comes from students' responses. Case 5 describes the construction of a system for individualised educational advice for teachers (the *operational curriculum*) based on the ACQA framework.

Case 3: The use of ACQA for quality assurance at institutional level – evaluation of design-based learning

In the years following 1998, an overall educational innovation was implemented at TU/e. Design-based learning (DBL) was incorporated as a basic pedagogic concept into the education system that until then consisted mainly of lectures and lab sessions. This innovation implied that all departments committed themselves to introduce the following features into their programmes or strengthen them: professionalisation, activation, co-operation, creativity, integration and multidisciplinarity (PACCIM), as described by Wijnen (1999). In the first and second year of every BSc's programme, so-called DBL projects were introduced or existing projects were extended, strengthening these features. An operationalisation of these features has been given by Wijnen et al. (2000). Years after the innovation, some limited evaluations have been done. On the one hand, the results suggested an overall implementation of DBL; on the other hand, the results suggested a great variation in implementation. Within the context of the self-study for institutional accreditation, a detailed evaluation was necessary. The questions to be answered were the following:

- To what extent has the DBL innovation been carried out as it was meant to be for the university as a whole?
- To what extent do differences in DBL implementation exist between programmes?

The evaluation was executed by using the data gathered for the ACQA profile measurements, i.e. 285 interviews held with teachers from eight of the 11 BSc's programmes. As there was not any assessment of the presence of PACCIM features in the programmes before the innovation, it was decided to compare the DBL elements in the programmes (DBL, the 'new') with the other elements (non-DBL, the 'old'). The classification as DBL or non-DBL was done by the programme directors. The comparison was threefold: (1) translation of PACCIM features into ACQA competencies and the comparison of DBL courses with non-DBL courses, where 'translation' usually meant combining several ACQA competencies or the relevance of dimensions into one variable; (2) the use of the wShole framework of ACQA to compare DBL courses with non-DBL courses; and (3) comparing the sizes of DBL and non-DBL between programmes and their influence on the programme profiles.

Summarised results are as follows (for details, see Perrenet et al. (2013)):

- Overall DBL has been implemented quite well: for five out of six PACCIM features, DBL scored significantly higher than non-DBL.
- Between programmes, some implementation differences exist on PACCIM: for four out of six PACCIM features, there are no pairwise differences; for two out of six PACCIM features, there are a few pairwise differences.
- Measured with ACQA, apart from PACCIM, substantial differences exist between programmes on DBL.

The results were in line with the trends found in earlier, more superficial evaluations: overall implementation, but with great variation. The main conclusion in the context of this chapter is that the framework has proved to be applicable at the institutional level, sensitive to the differences between programmes and explicit in detail.

Case 4: Comparing programmes on student competence results

Already in the early years of the ACQA activities, possibilities to measure and compare ACQA curriculum profiles in the *learned curriculum* perspective have been investigated, i.e. by the use of assessing the competencies of students.

The research questions were:

1. Is it possible to develop a valid and reliable test that measures the extent to which a student population meets a predefined set of criteria for academic education?
2. Is it possible to use that test to compare populations of students that are following different university programmes?

For this purpose only the segment of the framework with competence areas and competencies was used, because the dimension and level segment was still under development at that time.

About 100 students from three MSc's programmes took the 2-day test. The MSc's programmes were computer science and electrical engineering from TU/e and computer science from Radboud University Nijmegen. A discipline-neutral blueprint for this test was constructed, consisting of 15 assignments, covering the seven competence areas. From every area, a few competencies were selected with alternating BSc's or MSc's levels. Computer science and electrical engineering teaching staff added specific disciplinary contents to this blueprint. We will present an example item, firstly as formulated for the blueprint and secondly as formulated for both disciplines. Notice that especially the underlined part has to be differentiated towards both disciplines.

Blueprint example item

Within your field, the following problem is still open: *unsolved problem*. Explain why this question is still open and indicate what has to be done in order to solve this problem.

Competence 1, sub-competence 1 at master's level, discipline specific, no resources, 1 h, length of the answer about 1 A4

Evaluation: the quality of the description for the theoretical context, references and relevance of the example

Same item with Computer Science content

Within computer science, the following problem is still open.

The amount of software in consumer products such as televisions and cars still grows rapidly (in some cases even exponentially). Still, the number of errors per line of code remains more or less constant. Also the percentage of these errors that leads to events (crashes, error messages, strange behaviour) may be observed by users' stays more or less constant. As a result experts predict that for mobile phones, high-end TVs and cars that are currently under development, the average time between occurrences of annoying failures (the so-called mean time between failures) will be in the range between 1 h and 1 day. Even though the average Windows user got used to rebooting his/her PCs every day, one may expect that TV viewers and car drivers will not accept this. How can we combine the wish to further extend (through ICT) the functionality of consumer products with a consolidation (or even increase) of the present mean time between failures?

1. Explain why this problem is still open.
2. Indicate what has to be done in order to solve this problem. Identify a number of concrete, technical subproblems.

Your answer should consist of, at most, 680 words (approx. 1 A4). There is 1 hour available for this assignment.

Same item with Electrical Engineering content

Since the beginning of the 1980s, the telecommunications network has rapidly been 'glazed over', i.e. glass fibres have been replacing copper cables. This development started with long-distance connections, but nowadays glass fibres are used in neighbourhoods and even in various cities brought to the home (fibre-to-the-home). Optical network connections are also increasingly installed in buildings. Yet there is still a large market for copper connections for networks in buildings. It remains uncertain if glass/plastic fibres will fully replace copper in data traffic cabling in the near future.

1. Explain why this issue has not yet been fully resolved.
2. Which factors, at present, determine whether glass/plastic fibres or copper connections are used?
3. What should one know about both these connections to predict whether glass/plastic fibres will in the future replace all copper connections?

Your answer should not be longer than 680 words (approx. 1A4).
You have 1 h for this assignment.

Some items consisted of sub-items, i.e. an item concerning disciplinary knowledge consisted of a set of 60 binary multiple-choice items. Some other items were equal for both disciplines, i.e. the same content was suited for both disciplines.

The main result was positive: the construction method using a discipline-neutral blueprint delivered a proof of principle for the test asked for in the research questions, although construction and evaluation were time consuming. The test's validity (relevance, balance and generalisability) was comparable with the validity of a standard university examination. There were indications that some assignments were too difficult. The test's reliability (agreement between evaluators, reliability of the whole set, comparability of the assessment conditions) also was satisfactory.

The three programmes showed the following profile: the average student scores were low on the *disciplinary competence* area (1) and rather low on the *basic intellectual skills* (5). The scores were better, but still hardly satisfactory in absolute terms, for the competence areas *doing research* (2), *designing* (3), *scientific approach* (4), *co-operating and communicating* (6) and *taking into account the temporal and social context* (7). Neither the three profiles nor the three overall scores differed significantly. The majority of the students scored a little bit more than 50 % of the possible maximum score; a minority scored (much) lower. For more details see Perrenet (2006).

Case 5: TACTICs – Tips for Academic Competence Teaching, Inspired by the Criteria

Recently a Wiki website has been built at TU/e with various sorts of advice (hints) for teachers. Integrated in the wiki are a large set of hints on how to increase attention for a specific competency in the ACQA framework or to increase attention for a specific dimension. We give two examples. A hint in the system contains several fields, such as prerequisites, educational background, relation with other competencies, etc. We present only the description field.

Hint to increase the ***span*** **for** ***synthesis***
A design project typically contains a series of phases for synthesis, such as:

1. Requirement gathering
2. Defining functions
3. Designing a system architecture
4. Designing components
5. Integrating components
6. Optimising the system

During project work within education, students often use division of labour for reasons of efficiency or because of differences in expertise within the group. The quality of the end product might be better but the learning result

(continued)

per student might be worse, i.e. individual students might attend to certain phases (corresponding to levels of synthesis) of the project, while neglecting other phases (levels). This can (partly) be prevented by a specific set-up of a part of the assessment, i.e. an oral examination, preferably following the usual presentation by the group of the project results. In this oral examination per project group, the members are randomly questioned about all aspects of the project. This procedure should be announced at the start of the project, in order to stimulate the students to attend to all aspects. The procedure stimulates that students ask other group members about the details of aspects they are not directly involved in.

Hint to increase a specific competency in area 7

Is able to analyse and to discuss the ethical and the normative aspects of the consequences and assumptions for scientific thinking and acting with colleagues and non-colleagues (both in research and in designing)

The Ethic Game*, originally Back to the Basics, is a well thought-out game to support students in order to understand arguments concerning ethical discussions. In a playful way, the students become knowledgeable with the separation between relational, professional and public norms. They also learn to recognise their own reasoning and to support their own claims with argumentation.

1. Students read a case (or one reads aloud), in which an ethical dilemma occurs. The case ends with four to five possible actions.
2. A break allows all students to think through the case and to choose their own choice of actions.
3. A first student is chosen (or the one who reads the case out loud) and tells his/her preferred choice.
4. Every student is given the chance to express his/her level of agreement with the choice of the first student. This is done by giving points: 3 points stands for complete agreement, 2 points for substantial agreement, 1 point for partial agreement and 0 point for disagreement.
5. The lecturer asks the first student to explain his/her choice; next the fellow students are asked to react and discuss.
6. The lecturer sums up the different choice of options and to which norm each option of action is connected. The case is then further evaluated. In this evaluation the central question is: Do students recognise themselves in the sketched norm profiles?
7. The cycle might be repeated.

* Milius et al. (2001)

24.6 Further Spin-Off

We briefly describe some further initiatives which show the fertility of the ACQA framework.

For the programmes of applied mathematics and computer science, students at the end of their BSc programme were offered assignments for reflection on their learning. One of these assignments used the ACQA framework. The students had to construct a global ACQA profile, using seven competence areas, of their curriculum as experienced. Also they were asked for an ideal curriculum. In the case of computer science, this led to putting more research into the programme (see Case 1 before). Note that this application is in the *experiential* curriculum perspective.

A similar 'assignment' was given to all professors in the Department of Mechanical Engineering. The results led to interesting discussions and influenced curriculum reform.

In the case of the new MSc's programme Nuclear Fusion, the ACQA framework was used from the start, i.e. in the *ideal*, in the *formal/written* and in the *learned* curriculum perspective.

24.7 Proliferation and Evaluation

In this section we describe the application of ACQA outside the Eindhoven University of Technology. Next we will evaluate the quality of the framework and its use, mainly based on applications inside the TU/e.

24.7.1 Proliferation

The first university in the Netherlands after TU/e where ACQA was used was Radboud University Nijmegen. This university adopted the Criteria, and for several programmes in the Department of Science, a profile was constructed.

Together with Delft University and Twente University, Eindhoven University of Technology constitutes the so-called 3TU, the covering institute for Dutch universities of technology. Also at this level the Criteria have been adopted, and for some of the programmes, part of ACQA has been used: self-studies for accreditation follow the seven competence areas in their presentation.

Outside of the Netherlands, the framework was applied in three universities. At the Politecnico di Milano in Italy, a project for measuring the ACQA profiles has been partly executed. At the Technische Universität Berlin, part of the ACQA framework is still applied for establishing programme profiles; see also Raue and Steinbach (2009). Most extensive is the endeavour in Belgium at the Catholic University of Leuven, with the participation of the Departments of Engineering

Sciences, Bio-engineering Sciences and Engineering Technology, where detailed ACQA measurement as well as research into students curriculum experience is taking place (comparable to the activities at Eindhoven in the *experiential* curriculum perspective, described before); see also Londers et al. (2011).

Many of these applications were instigated by an international ACQA study conference in Eindhoven, 2007. Also presentations were held at several occasions at locations outside the Netherlands, such as ABET, TU9 (the German pendent of the Dutch TU3) and Conference of European Schools for Advanced Engineering Education and Research (CESAER), to name a few.

24.7.2 Evaluation

An evaluation of the quality of ACQA as an instrument for measuring programme profiles has been done by analysing the data of seven BSc's programmes and ten MSc's programmes from interviews of about a total of 566 courses (Perrenet et al. 2011). In this analysis only the structure of competence areas was involved. We adapted and used the quality criteria of Nieveen (1990) for educational products, i.e.:

- Content validity: Do the stakeholders accept the framework of competence areas – does it cover the contents of the study programmes and does it match with the intuition concept of 'academic'?
- Construct validity: Do the categories of the framework constitute a coherent structure without overlap?
- Practicability: Do the stakeholders understand the measurement procedure and its results? Is it efficient? Can it be applied to all disciplines?
- Effectiveness: Are the results of the measurement approved and do they get used?

We added further criteria for measuring instruments:

- Sensitivity: Do the measuring results differentiate between various types of programmes, such as BSc's programmes versus MSc's programmes or programmes from various disciplines?
- Reliability: Is the measurement independent of the specific interviewer?

The results showed the following (for details see Perrenet et al. 2011).

Incorporation of the framework into the TU/e educational vision document as well as in the institutional quality assurance document is an indication for *content validity*. The great majority of interviewees reacted very positively; often teachers indicated afterwards that the introduction to the ACQA framework and the analysis of their educational objectives presented them with a new and conducive view. Appreciative reactions from other universities have been described above.

No positive correlation was found between scores for competence areas (which would have been an indication of overlap in the structure). *Disciplinary competence*

(1), however, had a moderate negative correlation with areas *co-operation and communication* (6) and *designing* (3). An explanation might be the presence of design-based learning (see before, Case 1): subject courses (non-DBL) rely heavy on area 1, while DBL projects involve more of areas 3 and 6. This result concerns *construct validity*.

Almost all interviewees quickly understood the structure of competence areas. Adequate use in programmes varying from applied mathematics to architecture and building technology or science education and communication (teacher training) indicates *practicability* and *effectiveness*.

Sensitivity was observed to the differences between BSc's and MSc's programmes (specifically concerning area *doing research*). At all areas except area 6, differences emerged between different programmes.

Finally, overall, only small interviewer dependency could be discerned.

So the quality of the ACQA measurement proved to be quite good for competence areas. Other aspects of the framework have not been investigated yet.

24.8 Conclusions

The aforementioned has proven the value and usefulness of the ACQA framework. Firstly, it has become indispensable in the quality assurance of the educational system at Eindhoven University of Technology; ACQA is routinely used in the perceived curriculum perspective, describing teachers' intentions. Secondly, it is widely known and acknowledged in higher education in the Netherlands and Flanders, Belgium. Thirdly, it brought forward many application possibilities in other curriculum perspectives. Finally, opportunities exist for further international proliferation, especially in scientific technology education.

Looking back at the process, we can state that, since its inception in 2002, ACQA has been firmly established within TU/e. TU/e's education policy has become competence based in its quality assurance, at the programme as well as at the institutional level. One can expect that this will influence the curricula in all their perspectives, from ideal vision to learning results. Almost all programme profiles have been measured, and the results have been used for accreditation as well as for programme improvement.

The framework got attention at a series of universities, but apart from TU/e, it was thoroughly applied only at two universities. It is striking that in applications as well as in the investigation of the quality of the framework, the global competence areas get priority. Our impression from stakeholders' reactions is that academic staff members prefer the dimensional segment of the framework (they can identify with the disciplinary details), while education management and educationalists prefer the competence areas along with their competencies (for efficiency as well as for uniformity reasons). The competence area segment is much more easily exported than the dimension segment, as the latter needs construction activities and disciplinary expertise at every new (sub)discipline. Another interesting aspect of the framework

and its use is the claim that it fulfilled the need to differentiate between academic level and higher vocational level of education. Occasionally there has been the option to put this to a test, i.e. measure the ACQA profile of two programmes within the same discipline but at different levels and to compare the outcomes. However, ACQA has hardly been implemented in higher vocational education. The reason might be of a political nature, as possible outcomes of comparison might probably not satisfy all parties. Also the claim that the framework would fit the social sciences as well as the humanities has never been put to a practical test.

Currently, Eindhoven University of Technology is structurally revising all its BSc's programmes, putting more emphasis on relevant social science subjects, introducing a common technology core for all students and offering students more freedom to choose from electives. Measuring the ACQA profiles for the new curricula will bring new and interesting measurement problems: not only are there many new courses to be measured, but also the curricula have become much more fluid. Many differences exist for students, even if they have chosen the same major. Looking forward, we can expect new types of application and challenges to the methodology underlying the ACQA framework.

Annexes

Annex I: Levels for Analysing and Synthesising for the Discipline of Computer Science

Analytic Dimension

1.1 Code + documentation of a Java application 1.2 Extraction of a UML model from the code
2.1 The extracted model (given in UML diagrams) 2.2 Application of metrics onto the model, such as assessing fan-ins and fan-outs of classes in the class diagram
3.1 Characteristic dimensions of the model according to various metrics 3.2 A qualification of the stability of the application regarding extension, adaptation or usage in a different (technical) context

Synthetic Dimension

1.1 A plan for a new software product (instigated by a group of prospect customers) 1.2 Making an inventory of user's requirements
2.1 User requirement document 2.2 Developing a functional model of the intended product
3.1 A functional model for the product (software requirement document) 3.2 Developing a design for the application, taking non-functional requirements into account

4.1 The design for an application (software design document)
4.2 Implementing the application
5.1 The implemented application
5.2 Deploying the application as operational product in the environment as intended by the customers

Annex II: Levels for Abstracting and Concretising for the Discipline of Applied Physics

Abstract Dimension

1.1 A process or phenomenon from the physical reality
1.2 The formulation, in terms of sensory perceptions, of a law that underlies that process or phenomenon
2.1 The possible law formulated in terms of sensory perceptions
2.2 The formulation of this possible law in terms of physical quantities (velocity, force, charge, etc.) and principles (homogeneity, conservation, symmetry, etc,)
3.1 The possible law formulated in terms of physical quantities and principles
3.2 The formulation of this law as (a) mathematical relation(s) between mathematical objects that represent physical quantities (e.g. velocity interpreted *as vector*, angular momentum interpreted *as cross product*)
4.1 The assumed law from 3.2 interpreted as a mathematical relation (e.g. differential equation, constitutive equation) between mathematical objects (e.g. vectors, tensors, functions)
4.2 The construction of a mathematical derivation or manipulation that connects this mathematical relation to other, already known mathematical relations that correspond with physical laws that are assumed as valid
5.1 The mathematically derived relation that corresponds with the (assumed) physical law (from 4.2)
5.2 An argument based on a mathematical principle of which this mathematical derivation is a special case (e.g. Noether's theorem on the relation between conserved quantities and continuous symmetric groups with, as a special case, the derivation of conservation of momentum from translation invariance)

Concrete Dimension

1.1 A physical principle or process (e.g. photoelectric effect, piezoelectric effect) characterised by an input and an output and that is used for certain applications
1.2 The description of a system in which this physical principle or process manifests itself
2.1 A system (as described in 1.1) in which the physical principle or process characterised by an input and an output manifests itself
2.2 The description of this system by quantifying the relation between input and output (e.g. with a constitutive relation or a differential equation) either through measurement or theoretical prediction
3.1 A system (as described in 2.2) with a given quantitative relation between input and output
3.2 The description of this system taking into consideration at least one auxiliary principle or process (other than described in 1.1) which is partly responsible for the quantitative relation between input and output (e.g. hysteresis, saturation, noise)

4.1 A system (described in 3.2) in which the functioning is based on a physical principle of process, but in which at least one other principle or process is partly responsible for the quantitative relation between input and output
4.2 The description of this system in a quantitative form that includes the dominating principle or process as well as the auxiliary principle or process to sufficient accuracy, so that it enables one to ascertain, either experimentally or theoretically, whether or not the system is suitable for the application (as described in 1.1)
5.1 A system, suitable for the application of 1.1 (as described in 4.2)
5.2 To transfer the description of this system to a production context while taking the details of the fabrication process into consideration

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Chapter 25
Models and Principles for Designing Competence-based Curricula, Teaching, Learning and Assessment

Renate Wesselink, Harm Biemans, Judith Gulikers, and Martin Mulder

25.1 Introduction

This volume shows that competence-based education (CBE) is a global educational innovation which has gained popularity, because it is expected to stimulate learning that prepares students for the world of work and the society (Velde 1999; Mansfield and Mitchell 1996). CBE is a popular innovation in the vocational education and training (VET) system in many countries because the expectations are that it makes education more authentic and attractive for students. And because of this, fewer students are assumed to drop out of education before attaining their diploma, and graduates are expected to experience less transition problems when starting to work in the labour market (Biemans et al. 2004). CBE is applied in educational practice on a large scale in many different countries (Mulder et al. 2007), but not always accompanied with convincing evidence of its added value.

25.2 Complexity of CBE Design and the Limited Amount of Evidence of CBE Effectiveness

Although the expectations regarding the added value of competence-based education are formulated clearly (i.e. motivated students and a smooth transition to the labour market), it remains unclear to what extent these expectations are met. In the Netherlands, for example, Van den Berg and De Bruijn concluded already in 2009 that there were hardly any results on the effects of CBE in relation to the labour

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market (only some preliminary findings). In the period before 2009, there were hardly any students who completed an entire competence-based programme. Since then, no studies were conducted on the effects of CBE in the Netherlands (Van den Berg and De Bruijn 2009). Van der Meijden et al. (2013) provided a study in which they compared the situation of Dutch VET institutions that joined experiments in which they started to use the (national) competence-based qualifications structure with VET institutions that did not yet implement the new qualifications structure. They studied the differences on the following areas: transfer to the labour market, motivation of students and commitment of the companies involved. They also studied factors like the role of the teachers and the number of drop-outs, but in this chapter the first three result areas (transfer, motivation and commitment) will be discussed only. Van der Meijden et al. (2013) conducted interviews with key respondents from both companies and educational institutes, and concluded that it was too early to say something about the effects of using a competence-based qualifications structure on the transfer of students to the labour market. However, it was expected that students who were educated based on a competence-based qualifications structure acquired more so-called 'soft' skills, which would smoothen their entrance to the labour market. One of the observations of Van den Berg and De Bruijn (2009) was that educational practitioners have the impression that students after their graduation in CBE are able to more quickly find a job and that they experience fewer transition problems. This conclusion is not based on hard empirical data, however, but is based on the experiences of educational practitioners involved in CBE programmes. Based on the same research of Van der Meijden et al. (2013), it can be concluded that the motivation of students participating in educational programmes that adopted the national competence-based qualifications framework does not differ from students participating in more traditional programmes that did not yet adopt the national competence-based qualifications framework. The only conclusion that can be drawn is that there is a positive relationship between the extent to which the educational programme can be characterised as CBE and the motivation of students. So the more the educational programme is based on competencies (that means in many cases that the programme has been working with a competence-based qualifications profile for a longer period of time), the higher the motivation of students. Van der Meijden et al. (2013) finally reported that companies that are involved in a competence-based programme show more commitment to the educational programme than those that are involved in more traditional programmes. Furthermore, these companies are also more satisfied about the extent to which they are involved. Thus, this research of Van der Meijden et al. (2013) shows positive outcomes of the implementation of CBE programs, but as said, these conclusions are not built upon large-scale empirical data. It is still unclear to what extent study programmes that adopted the national competence-based qualifications framework actually changed their teaching, learning and assessment remains.

In Australia the implementation of so-called CBE training packages was evaluated on a national level. Training packages were the carrier for the implementation of CBE and were nationally recognised qualifications based on competency standards and developed with considerable input from the industry. Because of the

implementation of CBE, Smith et al. (2009) highlighted some major changes during the last 20 years. Several researchers evaluated the implementation of these training packages in Australia. Cornford (2000), for example, concluded that it was still not known whether or not students start with less problems regarding the transition into the labour market than before; the evaluations did not show results that pointed in that direction. He concluded that teaching professionals (with whom he evaluated the implementation of CBE) did not indicate that students' skill levels had greatly improved with the introduction of CBE. And when it comes to student motivation, a vast majority of teachers in VET had severe doubts whether students' motivation was enhanced as a result of CBE. He nuanced this conclusion somewhat by emphasising that CBE seemed to be suitable for some specific occupational areas. Based on the opinion of teachers involved in the particular areas, he considered CBE as beneficial for their specific areas (i.e. communications, jewellery); however, again, this was not empirically verified. The same evaluation in Australia yielded some curriculum changes: (1) the nature of curriculum went from descriptive and prescriptive to permissive; (2) the location of delivery was originally only in the classroom, and increasingly it was in both the classroom and the workplace; and (3) the role of the teacher evolved from being a gatekeeper to being a negotiator in the learning process. In Australia, as in the Netherlands, the evaluation activity did not incorporate the changes in teaching, learning and assessment as independent variables. The mentioned changes in the nature of curricula were even positioned as outcomes in the evaluation research.

Both examples show that there is a lack of evidence regarding the realisation of the intended outcomes of CBE. At least, the available results are not yet very convincing. According to Van den Berg and De Bruijn (2009), designing and implementing CBE at an educational programme level, when one takes it seriously, takes much time and involves an inclusion of a variety of dependent (i.e. student motivation) and independent variables (i.e. assessment). Van den Berg and De Bruijn (2009) stress that one can only measure effects when the whole programme has been developed and implemented, which means that in evaluating CBE teaching, learning and assessment should be incorporated as independent variables. Specifying competencies to be acquired by students alone does not automatically result in the design of effective competence-based learning arrangements (Biemans et al. 2009). More is needed.

What is needed is careful planning, designing and implementing effective ways of competence-based learning that integrate relevant knowledge, skills and attitudes (which relates to the notion of integrated occupationalism as presented in Chap. 1 of this volume) that take place in realistic and meaningful situations (related to the notion of situated professionalism; see Chap. 1 as well) (cf. Delamare Le Deist and Winterton 2005). In this regard, Watson (1991) cites Grabowski et al. (from 1981, p. 7): 'It is relatively easy to develop lists of competencies, (it is) very time consuming and expensive to develop the training and evaluation packages based on these competencies'. This issue of 'translating' competence frameworks into curricula and instruction relates to what Lum (1999) has indicated as the friction between competence as goal of education and a competence-based education strategy.

In the remainder of this chapter, details will be presented about models that are developed to implement CBE in VET institutions. First, some general models will be described, and afterwards, concrete guidelines on how to design CBE will be shown. These models should be taken into account when evaluating the effects of CBE, to get a good picture to what extent CBE really meets its expectations.

25.3 Models for Designing CBE and Implications for Educational Design

In this section several models for CBE will be presented. This will be helpful for both scientific and practical communities as it shows what CBE actually entails. The main selection criterion for these models was the comprehensive approach of competence (see Wesselink 2010).

An important observation to start the presentation of the CBE models is that CBE needs a balance between standardisation and individualisation of education. Watson (1991) described this dimension of CBE already 25 years ago. This dimension is still current, as much opposition against CBE approaches is related to the issue of standardisation. According to Watson (op. cit.), standardised competencies on the one hand have a central position. This means that: (1) role-relevant competencies including standards are identified and stated, (2) competencies are specified to students prior to instruction, (3) criterion-referenced measures are used to assess the level of students' competence development and (4) a system exists for documenting the competencies developed by each student. On the other hand, he states, in order to achieve maximum flexibility, CBE requires some form of individualised learning: (1) individualised materials and methods are used in instruction, (2) learning time is flexible and (3) learning is guided by feedback. Knowing the positions on the dimension standardisation versus individualisation, one might think these two characteristics are not compatible in CBE, but the opposite is true. The strength of CBE lies in the fact that these standardised competencies are translated into the context of the individual student so that they become meaningful for that particular student; this translation allows for flexibility on the student's level.

As shown in the following section, regardless of their different background (policy development, policy evaluation, curriculum development or educational research), most theoretical frameworks incorporate the aforementioned standardisation-individualisation dimension. This is, for instance, visible in the model of the Inspectorate of Education (2007) in the Netherlands, which is a model for policy development and policy evaluation purposes. This model includes the following aspects: (1) integration of knowledge, skills, and attitudes; (2) orientation on acting (in the domain of the profession); (3) focus on the individual; and (4) focus on the development of the individual's career. It is also visible in other models which originate from research. Some of these will be presented below. This presentation is illustrative, and not meant as an exhaustive overview of all existing models

for CBE. The models which will be presented are selected to represent different backgrounds (i.e. discipline, research, policy), which are indicative for the diversity and complexity of CBE.

First of all is the model of Van den Berg and De Bruijn (2009). Based on experience and extensive research involving many different stakeholders (i.e. researchers, teachers, curriculum developers), these authors described CBE by means of the following aspects:

1. *Learning by self-steering*: on the one hand, this is deemed necessary because the demands of the labour market require that graduates are able to navigate their own careers; on the other hand, more self-steering fits the theory of self-regulated learning – making the students responsible for their own learning process to enhance their motivation and depth of learning;
2. *Learning in the workplace/workplace learning*: this aspect stresses the importance to enlarge the amount of time spent on learning in the workplace; this is especially important because of the necessity to bridge the gap between education and the labour market;
3. *Meaningful learning*: the challenge in this regard is to connect the learning outcomes of the workplace with reflection (from a distance), which together will make learning more powerful and meaningful;
4. *Flexibility*: this concerns flexibility of the content of the learning trajectory and flexibility in relation to the pedagogical-didactical approach.

Second, in the field of health education, Gruppen et al. (2012) described CBE as a framework for designing and implementing education that focuses on the desired performance characteristics of health care professionals. According to them, five characteristics of competence and CBE do exist:

1. Competence focuses *on performance* in terms of the end product or goal's state of instruction: by emphasising the results of education rather than its processes, CBE provides a significant shift in what educators and policymakers look for in judging the effectiveness of educational programmes.
2. Competence reflects *expectations that are external* of the immediate instructional programme; success is determined by the individual's ability to perform up to expectations that are largely determined by stakeholders outside of the educational programme itself.
3. Competence is expressible in terms of measurable behaviour; assessments emphasise behavioural measures that depend on *integrating knowledge, skills and attitudinal aspects* derived from an aggregate of educational experiences and parts of the curriculum.
4. Competence uses a standard for judging competence that is not dependent upon the performance of other learners; *criteria for performance standards are determined by the judgement of practitioners and educators in the field.*
5. Competence informs learners and other stakeholders about what is expected from them; CBE is *transparent* and accountable to learners, policymakers and other stakeholders.

The models of Van den Berg and De Bruijn and Gruppen et al. are developed with a research purpose in mind. The crucial difference between both models is that Van den Berg and De Bruijn (2009) mainly focus on the self-regulated character of CBE by means of flexibility and self-steering (two out of four CBE aspects deal with the self-regulated nature of learning processes), whereas the focus of Gruppen et al. (2012) is on the relationship between education and practice. In general, stakeholders from practice are relevant parties, and mentioned several times in the defining characteristics of CBE.

Another research-based example of CBE frameworks is the model of Sturing et al. (2011), which builds on a previous model developed by Wesselink et al. (2007) and Wesselink (2010) and theoretical principles as generated by Mulder (2001, 2004). The model of Sturing et al. (op cit), also known as the comprehensive competence-based education (CCBE) model, includes ten essential CBE design principles at five implementation levels (ranging from not competence based to completely competence based) and was validated in senior secondary vocational education by both educational experts and teachers. The model as a whole, including the descriptions of the levels of implementation of the principles of CBE, is meant to support the development of CBE in practice. The model is the only one known to describe different levels of implementation. The so-called completely competence-based level is representing the full implementation level of the given principles. The design principles and the implementation of these at the full implementation level are presented below:

1. The study programme is based on core tasks, working processes and competencies (the qualification profile as defined with help of the labour market).
2. Complex vocational core problems (as present in the labour market) are central.
3. Learning activities take place in different concrete, meaningful vocational situations.
4. Knowledge, skills and attitudes are integrated.
5. Students are regularly assessed.
6. Students are challenged to reflect on their own learning.
7. The study programme is structured in such a way that the students increasingly self-steer their learning.
8. The study programme is flexible.
9. The guidance is adjusted to the learning needs of the students.
10. In the study programme, attention is paid to learning, career and citizenship competencies.

As said, for each design principle, five implementation levels are described (referred to as ‘not’, ‘starting to be’, ‘partially’, ‘largely’ and ‘completely’ competence based). Thus, in its most elaborated form, CCBE is defined by the descriptions of the fifth implementation level (‘completely’ competence based) of the ten design principles (Sturing et al. 2011):

1. During the development of the study programme, the qualification profile is at all times used and the programme is synchronised with practices and developments in the profession. Teachers are familiar with the qualification profile.
2. Complex vocational core problems are at all times central to the study programme and are assessed in many different contexts. The complexity of the problems increases during the study programme.
3. Participants always work (both in and outside school) individually and in teams on learning activities that take place in various meaningful, concrete practice settings. A link is always made between classroom learning and learning through practical experience.
4. Knowledge, skills and attitudes are always integrated in the learning process. Knowledge, skills and attitudes are assessed as an integrated whole.
5. Assessment takes place before, during and after the learning process and is both qualifying and focused on the competence development of students. Students determine the timing and format of assessment themselves. Representatives of vocational practice are at all times involved in the assessments.
6. Students are at all times challenged to reflect on their learning, the learning outcomes and the occupation.
7. The study programme offers at all times possibilities for self-steering. Students design their own learning process. The students' self-steering of their learning process increases during the programme. Each student is ultimately self-responsible for his/her own learning process.
8. The study programme is flexible and planned with the coach based on the characteristics of the student.
9. The teacher is a coach, mentor and expert. The teacher offers varied guidance which at all times is adjusted to the learning needs of the students. Students are stimulated to help each other.
10. Attention is paid at all times to learning, career and citizenship competencies during the study programme. These competencies are integrated in the study programme.

Although, the CCBE model as formulated above is still quite generic, the last list already contains more detailed specifications mainly because of the further elaboration of the distinct levels of CBE implementation in educational practice. Elements of the other models of CBE can be recognised in the CCBE model (i.e. self-regulated learning, relationship with practice).

When reflecting on all models, it can be concluded that aspects of both integrated occupationalism (integration of knowledge, skills and attitudes) and situated professionalism (meaningful learning, in context, more time should be spent in practice) are included. Besides, there is a changing role for the individual (i.e. self-regulation), and attention should be paid to the future careers of students. As mentioned before, this could be indicated as the core of CBE in VET.

The described models show similarities (and also differences), but even knowing these similarities, these models are still not really ready for guiding curriculum design, let alone that they are directly instrumental for teaching and learning

activities and assessment. Translating competence-oriented goals into actual learning arrangements taking place in different authentic situations is crucial in the implementation of CBE. If CBE implementation gets stuck at the preparation phase and/or does not get carried into the implementation phase of actual learning arrangements, true innovation will fail and realisation of the expected benefits will not be possible (Biemans et al. 2009). Therefore, in the next section of this chapter, the CCBE principles will be further operationalised to offer more specific guidelines that can guide the design of learning arrangements in CBE.

25.4 Operationalising CBE by Using Vocational Core Problems

Efforts necessary to realise CBE include, among other things, defining relevant vocational core problems in order to support and connect learning and assessment in school and in the workplace. In the Netherlands, these vocational core problems are described in competence-based qualification profiles. Biemans et al. (2009) show that Dutch institutions for vocational education have made considerable efforts to design, develop and implement new competence-based learning activities and assessments based on these competence-based qualification profiles, and these profiles are, at least for senior secondary vocational education, determined at national level. Compared with profiles developed in France, Germany and the UK, the Dutch qualification profiles have a dual character (Brockmann et al. 2008). They focus both on the output (competencies necessary for successful performance in practice) and input (characteristics of individuals necessary for successful performance). Where Germany mainly focuses on the output, the UK focuses on the input. France shares the dual position of the Netherlands.

In the Netherlands, the ultimate goal behaviour, required core job tasks, professional dilemmas, relevant competencies and their specific results defined as observable performance indicators are described for all vocational core problems (i.e. sometimes labelled as critical job situations) specified for one profession (see also Gulikers et al. 2009 for more examples). A vocational core problem is a description of a realistic and contextualised professional situation that involves performing a complex combination of job tasks and dealing with professional dilemmas (Biemans et al. 2009).

An example of one vocational core problem in the dairy sector, as part of a qualification profile for green education, is presented in Table 25.1. The complete competence-based qualification profile contains two vocational core problems: (1) taking care of production and the animals (see Table 25.1) and (2) optimising business activities. In this chapter one vocational core problem will be presented to illustrate vocational core problems in general.

In the Netherlands, the process of constructing the qualification profiles is organised at the national level. However, as stated before, these profiles do not contain

Table 25.1 Example of a vocational core problem for the qualification profile animal care specialist. This programme counts 4 years, at the senior secondary vocational education level, and is comparable with level 5 in the European qualifications framework

Vocational core problem	The animal care specialist at a dairy farm takes care of, feeds and milks the cows and takes care of their living environment in such a way that the animals stay in good condition and the working environment such that the people involved are at ease. The animal care specialist also facilitates the reproduction and breeding processes of the animals in such a way that the production of planned and healthy offspring is guaranteed
Job tasks	Feeding animals
	Take care of animals
	Milk animals
	Take care of environments of animals and people involved
	Facilitate reproduction and breeding processes
Professional dilemmas	Quality versus efficiency
	Animal welfare
	Safety versus business results
Competencies	Decision-making and initiating activities
	Collaborating and consulting
	Acting ethically
	Formulating and reporting
	Using professional expertise
	Applying relevant materials and means
	Planning and organising
	Producing quality
	Following instructions and procedures
	Dealing with pressure and setbacks
Performance indicator (example)	Feeds safely, efficiently and according to procedures held at the farm *(addressing core task 'feeding animals' and competency 'following instructions and procedures')*

any specific information for the teaching, learning and assessment activities: teachers often mention that they have not yet developed a suitable set of assignments to be carried out by students within the context of CBE. In many cases, the assignments they come up with are directly derived from the traditional learning materials meant for direct instruction. Thus, in the coming years, further development of suitable competence-based learning arrangements and activities that truly inspire students and enable them to study in a more meaningful and integrated way remains an issue of high priority. To ensure that this process is going to succeed, teachers should be supported in implementing the new learning arrangements in their own educational practice. The following section provides guidelines how competence-based learning arrangements can be designed and examples of inspiring learning environments that can be used within the context of CBE.

25.5 Further Specific Guidelines to Develop Learning Arrangements in CBE

As mentioned above, in most cases, existing qualification profiles, including relevant vocational core problems, provide the starting point for CBE. In the qualification profiles the 'what' aspects of the curriculum are described. This refers to the curriculum content in terms of essential vocational core tasks, corresponding working processes and relevant competencies with underlying knowledge, skills and attitudinal elements, or in other words, the principles 1, 2, 4 and 10 from the CCBE model.

But how to take care of the 'how' aspects of the CCBE model, i.e. principles 3, 5, 6, 7, 8 and 9? In the following section, the process of CBE design is explained by means of the following steps: (1) development of summative competence-based assessment, (2) design of practical learning situations, (3) formulation of concrete learning questions and (4) composition of personal learning arrangements.

25.5.1 Development of Summative Competence-based Assessment

The design of CBE starts with the development of a summative competence-based assessment corresponding to the vocational core problems (see Table 25.1) from the particular qualification profile. Thus, designing the assessment in not the apotheosis of curriculum development, but rather the starting point. This is a critical factor as the summative assessment is *the* most steering factor behind student learning (Dochy and McDowell 1997). These summative competence-based assessments (CBAs) should be aimed at judging whether or not a student is competent in dealing with the vocational core problems, according to the standards expected of a starting professional (as specified in the qualification profile). To assess whether or not a student can competently deal with the vocational core problem in various situations, a competence assessment *programme* is required instead of a one-shot assessment method (Van der Vleuten and Schuwirth 2005). A competence assessment programme (Baartman et al. 2006) is a combination of assessment methods that together allow for a reliable and valid judgement about a students' competence. A simple guideline for developing a competence assessment programme can be offered using Miller's Pyramid (1990). Miller describes professional competence in four layers: 'knows', 'knows how', 'shows how' and 'does' level in which the lower two levels address students' knowledge or cognitive capacities, while the two higher levels are geared towards performance. Miller makes a connection between the content of the assessment ('the what') and the assessment methods that are fit to measure this content ('the how'). Going up in the pyramid, the assessment methods increase in their authenticity in the sense of being representative of the vocational core problem (Gulikers et al. 2008). A simple guideline for a competence-based

assessment programme is that this should include at least one assessment at the 'knows' or 'knows how' level of Miller's pyramid (1990) and one assessment at the 'shows' or 'does' level that is very authentic with respect to the vocational core problem and requires students to actually perform the vocational core problem (Baartman and Gulikers accepted). These performance assessments require careful observation by, preferably more than one assessor and assessors from practice.

The summative CBA in the case of the animal care specialist could be to take the lead on a farm with animals without supervision of the farmer him- or herself for a particular period of time. The CBA programme can consist, for example, of (1) an observation of the student's performance or a video of this performance (does), (2) a logbook in which the student concretely describes all undertaken activities (does) and (3) a criterion-based interview in which an assessor asks the student critical questions about his/her conducted tasks, dealing with the professional dilemmas, and the reasons for performing the way he/she did (knows how), and/or (4) a knowledge test on animal diseases and symptoms and feeding/food possibilities or problems (knows).

25.5.2 Design of Practical Learning Situations

Next, practical learning situations for the students should be designed that are aligned with the CBAs. These practice situations in which students are expected to develop their own competencies take a central position in the students' learning process. There should be a direct relation between the practice situations and the corresponding CBA (Gulikers et al. 2008): Students often appear to experience insufficient alignment of their school assignments, their workplace training tasks and the CBAs (Biemans et al. 2009; Gulikers et al. 2009), and this misalignment is critical for assessment quality and in turn teaching and learning quality (Gulikers et al. 2013). To achieve this alignment, the practice situations should be directly derived from the particular CBA in the sense that they focus on the same vocational core problems and professional dilemmas and appeal to the same competencies. In other words, the practice situations should be authentic as well and reflect real-life complexity. Within the context of a particular CBA, each student should be confronted with several practice situations, which together cover the whole CBA. The coach determines, together with the student, which concrete practice situations will be chosen as part of the learning process. Additional to and supportive of performing and practising in practice situations, a supporting line of disciplinary knowledge (e.g. a course on animal diseases, symptoms and food/feeding possibilities) or routine skills training (e.g. cleaning barns or using hygiene procedures when working with animals) can be offered alongside the practical situations (Van Merriënboer 1997). However, the links between these disciplinary courses or skills training and performing professional practice situations should be explicit and is of the utmost importance, as this transfer will not automatically happen (Baartman and De Bruijn 2011). Thus, in CBE knowledge and skills courses can have a place, but not as

isolated activities, but always related to and supportive of professional practice situations.

25.5.3 Formulation of Concrete Learning Questions

These practice situations should lead to concrete learning questions of the individual student, which steer his or her competence development and foster active learning. In collaboration with a coach, students should be stimulated to think about: 'What tasks have I already mastered and what (parts of the) tasks in my qualification profile should I pay additional attention to and practise some more?' Therefore, as part of the CBE design process, a set of possible relevant learning questions can be defined in advance related to each CBA and corresponding vocational core task. An example of a learning question is: being responsible for the sales department, how can one maximise profit and be friendly to the customers at the same time (learning question related to a critical job situation of a retail salesman)? It is the responsibility of the coach to determine, together with the student, which learning question can be addressed at what stage during the learning process.

25.5.4 Composition of Personal Learning Arrangements

Next, together with his or her coach, each student should compose his or her own personal learning arrangement (consisting of various specifically designed learning activities and corresponding student assignments, tools, resources, etc. in the framework of the relevant vocational core problem), which is directly related to the student's specific learning question and specifically comprised to promote his or her own competence development. Therefore, in the design process of CBE, it is important to explicitly define possible learning questions corresponding with a particular vocational core problem (or CBA) before developing concrete learning activities. This means that educational designers take possible learning questions of students as starting point (in the preparation phase); otherwise, the design process may become too instrumental, meaning that the CBA is directly translated into more or less isolated student assignments with the risk of fragmentised learning. In this step it is crucial to try to look through the eyes of a student and not from the perspective of a discipline. If this crucial step is taken from the disciplinary perspective, the chance is big that traditional assignments will be used (again). When an educational designer looks from the viewpoint of the student, he or she will come up with assignments that are meaningful and resemble practice for the student, so it is not up to the student to integrate the obtained knowledge or skills into the CBA or vocational core problem. This integration was already clear before the start of the assignment.

In CBE, the learning questions of the students provide direction to their learning processes; it is to be expected that students who are just about to start within CBE experience difficulties with formulating their own learning questions. Coaches should support them, and a set of realistic possible learning questions could be helpful. When students become more experienced in CBE, they should be able to come up with learning questions themselves and formulate, together with their coach, relevant learning activities. Moreover, it would be preferable to design several learning activities and corresponding materials for each specified learning question. This increases the chance a student can choose a learning activity that he or she appreciates the most (choosing also reflects some kind of self-directedness). As a start of the actual learning process, coach and student make a selection from the available learning activities or develop new learning activities in order to answer the student's learning questions. CBE is mainly demand-driven and flexible; however, when a student starts within CBE, he or she should be supported to uptake this self-directed role step by step.

Table 25.2 provides an example of a specific competence-based learning arrangement based on a CBA for animal care specialist presented in Table 25.1. This example starts with the expected ultimate goal behaviour (as described in Table 25.1). Next, related practice situations are presented followed by possible relevant learning questions and corresponding possible learning activities (and learning materials).

To summarise, different components should be designed as part of the process of realising CBE:

1. Summative competence-based assessment programmes (CBAs)
2. Related practical learning situations (including supportive knowledge and skills)
3. Relevant personal learning questions (already prepared for starting students)
4. Corresponding learning activities and materials put together in a personal learning environment

Table 25.3 provides a set of design aspects with corresponding questions for design teams to ensure the quality of the various CBE components.

25.6 Inspiring Learning Environments Within the Context of CBE

Within the context of the design and implementation of CBE, authentic, powerful and inspiring learning environments are regarded as being crucial (see also De Bruijn and Leeman 2011). In these learning environments, students are enabled to optimally develop their competencies for handling professional core problems (e.g. through apprenticeships, practical simulations, and project-based workplace learning; three frequently used professional learning contexts in secondary and higher vocational education programmes – see for more details Khaled et al. 2014). When

Table 25.2 Example of a concrete competence-based learning arrangement based on the vocational core problem for animal care specialist (the first part is identical to Table 25.1)

Vocational core problem	The animal care specialist at a dairy farm takes care of, feeds and milks the cows and takes care of their living environment in such a way that the animals stay in good condition and the working environment such that the people involved are at ease. The animal care specialist also facilitates the reproduction and breeding processes of the animals in such a way that the production of planned and healthy offspring is guaranteed
Related practice situations (under supervision of the farmer)	Feed the cows at a real dairy farm
	Take care of the cows
	Milk the cows
	Take care of the environment of the cows
	Facilitate reproduction and breeding processes of the cows
	Integral animal care at the farm (combining the practice situations mentioned above)
	Integral animal care at a different dairy farm
Possible relevant learning questions	How can I be sure that the cows get enough to eat and that I do not waste animal food at the same time?
	How do I recognise when a particular animal is not healthy and how do I take appropriate action?
	How do I milk the cows as efficiently as possible?
	How do I recognise when a particular aspect of the farm environment could have a negative influence on the cows?
	How can I select cows for breeding?
	How can I prioritise my activities when I am responsible for integral animal care at the farm?
	To what extent does integral animal care differ between the two farms?
Corresponding possible learning activities	Interview the farmer how much food the cows need exactly and provide this to the animals without spoiling
	Study information sources on symptoms of health problems of cows and determine to what extent such symptoms are present
	Try to milk the cows as efficiently as possible and analyse which factors influence milking efficiency
	Study information sources on environmental factors that influence animal welfare in a negative way and determine to what extent these factors are present at the farm
	Study material on breeding processes of cows and determine what this means for this particular farm
	Interview the farmer on integral animal care management at the farm and priorities in this regard and act accordingly
	Analyse the differences in integral animal care management at both farms and describe what these differences mean for your management priorities

Table 25.3 Design aspects and questions to ensure the quality of the various CBE components

CBA	
Assessment programme	Does the combination of assessment activities offer a complete picture of students' competent performance?
Competencies	Are all competencies defined in the CBA addressed in the other CBE components (practice situations, learning questions and learning activities)?
Alignment	Is the vocational core task and belonging professional dilemmas of the CBA used as starting point for the other CBE components (practice situations, learning questions and learning activities)? That is, are all the CBE elements (e.g. CBA, vocational core problems, learning questions, learning arrangements) aligned?
Practice situations	
Dilemmas	Do the practice situations include professional dilemmas that force the students to make choices?
Complexity	Are the practice situations sufficiently complex (in alignment with CBA)?
Variety	Are the practice situations sufficiently diverse?
Student level	Are the practice situations attuned to the cognitive and prior knowledge level of the students?
Challenging	Are the practice situations future-directed and challenging?
Authenticity	Are the practice situations authentic (resembling critical professional situations)?
Meaningful	Are the practice situations meaningful for students, school and the particular business sector?
Learning questions (composed by either educational designers or students themselves)	
Kind of learning questions	What kind of leaning questions are students likely to come up with when facing the vocational core problem?
Knowledge/ skills/attitudes	Are their specific knowledge, skills or attitude components that require additional learning activities?
Self-assessment	Are students supported in self-assessing their strengths and weaknesses to come up with learning questions?
Recognisable	Are the learning questions recognisable for the students?
Insight/application	Are the learning questions mainly aimed at insight and application (and not at reproduction)?
Providing direction	Do the learning questions provide direction to the learning process?
Learning activities	
Integration	Do the learning activities require integration of relevant knowledge elements, skills and attitudes?
Explicit relation to core task	If there are more or less isolated knowledge, skills or attitude training activities, are these explicitly related to and supportive of performing the vocational core problem?
Focus on learning results	Is it clear to what learning results the learning activities should lead?
Reflection	Do the learning activities lead to reflection on learning process and learning results?
Connection between the four CBE components: final crucial check	
Connection	Are the four CBE components (CBAs, practice situations, learning questions, learning activities) sufficiently connected and is the connection transparent for all parties involved (teachers, students and workplace supervisors)?

looking at the educational design steps mentioned above, these learning environments should incorporate professional practice situations, allowing for individual learning questions and opportunities for choosing and practising in various learning activities. As such, these powerful, inspiring learning environments should properly prepare students for their summative competence-based assessment. Powerful learning environments in CBE, certainly in vocational education, inevitably require connectivity between learning in school and learning in the workplace (Griffiths and Guile 2003; Tynjälä 2009; Wesselink et al. 2010). There are already many promising initiatives in the Netherlands but also in other countries all over the world at various educational levels in which competence-based learning environments have been developed, implemented and occasionally evaluated. In some cases, this concerns local initiatives, while in other cases, cooperation exists at a regional or even national level (Biemans et al. 2009).

Implementing CBE requires redesigning existing education (see the four steps mentioned before): competence-based learning environments could incorporate the CCBE principles formulated earlier to ensure that actual competence development will take place. To help schools to choose and develop appropriate competence-based learning environments, a specific set of prototypical and so-called inspiring learning environments was designed and evaluated by Schaafsma et al. (2007) (see Table 25.4). These learning environments are presented in this chapter to provide ideas of possible alternatives educational designers could think of depending on what they want to achieve in a particular learning environment (e.g. skills development, role modelling, knowledge transfer). Every inspiring learning environments described in Table 25.4 is more or less suitable for specific purposes. For example, the studio is good for practising skills in groups, a masterclass aims at inspiring people via bringing innovative knowledge and insight in a certain field, and a clinic is very effective for supporting creativity, brainstorming and opportunity identification. This list of inspiring learning environments can open educational designers' eyes to the wide variety of possibilities to inspire and develop students in CBE. However, the effective use of this range of inspiring learning environment requires that educational designers clearly define for what goal they are developing a learning environment. Depending on that goal, a specific prototypical learning environment is more or less suitable.

Next to the intended learning goals, variables such as student level, number of students, goal of the course or teacher capabilities influence the decision for adopting a certain learning environment. Apart from a careful selection or design process, clear communication between teachers and students about goals and procedures of the intended learning activities within the learning environments, and their link to the professional task students are working towards, is of vital importance. Finally, students should be supported by their teachers while performing these learning activities. Under these conditions, competence-based learning environments can be truly inspiring (Biemans et al. 2009).

Schaafsma et al. (2007) showed that, at the beginning of their learning trajectories, students prefer learning environments mainly characterised by external regulation (by teachers, coaches, etc.). During these learning trajectories, their preferences

Table 25.4 Examples of innovative inspiring learning environments within the context of CBE

Learning environment	Description	Learning activities
Masterclass	Expert provides suggestions and examples and shares experiences to inspire students	Classes Storytelling Cases
Clinic	In-depth (practical) training by expert who coaches the students individually and intensively (short term; learning by doing)	Demonstration Exchange experiences with professionals Practical Course Training Workshop
Atelier	Creativity sessions to support students in abandoning existing conceptions and borders to find other directions and opportunities to solve problems (self-expression, intuition, stimulating environment)	Brainstorming Mind mapping Storytelling (Self-)reflection (personal development) Inventing different scenarios for problem solving
Laboratory	Solving a real-life (technical) problem by experimenting with different solutions in a safe environment Focus is on the development of content (i.e. product, concept or solution)	Problem analysis Research design Protocols Simulation
Academy	Transition from science to practice Knowledge circulation from (international) research Researchers provide students with more theoretical background and help to broaden their scope	Classes Lectures Seminars Symposia
Studio	Students work individually or together on a problem assisted by a coach Learning from mistakes Focus on the importance of networking	Training Teamwork Developing routines Presentations
Professionals pub	Students arrange events and meetings on a special theme or problem and invite professionals and experts to share their experiences and go into debate. Students get the opportunity to network and meet new people (infotainment, incidental meetings)	Lectures from inspiring guest speakers Team quiz Digital/virtual support (e.g. discussion panel)

(continued)

Table 25.4 (continued)

Learning environment	Description	Learning activities
Boxing ring	Competitive environment in which better performance is rewarded Students practise for a performance (contest) supported by a coach (/expert/professional). During the actual performance they should be aware of their environment and their competitor and stick to the rules	Training and coaching Debate Discussion Management games Simulation games Development of innovative products
Kitchen table	Quiet and safe environment in which (personal) experiences can be shared, and there is room for self-reflection. Feedback and reflection can take place between the student and his/her coach, an expert, professional or peer student	Dialogue Reflection session Feedback (expert/peer, 360°)
Utopia	A group of students works on a real-life case in a social context. They need to find a compromise between different stakeholders in order to find possible solutions	Interview Debate Discussion Negotiating Problem analysis Presentation
Study club	Exchanging practical experiences on a certain theme or subject Problems or topics faced by students during their work, training period or internship can give input for organising meetings around these topics with other students and professionals or experts	Guest speakers Enterprise visit Enterprise audit System analysis In-depth interview ("mirror" of professional) Benchmarking
Expedition	By stepping out of his/her own environment, the student can learn from other perceptions which can change his/her world of view Moving borders and changing views This experience can give the student new understandings and other opinions and also stimulate (self-)reflection when travelling without clear goal, destination or path	Excursion Study visit Survival Journey report Self-reflection Benchmarking

move in the direction of more open learning environments characterised by regulation by the students themselves. Thus, during their educational programme, the students' needs for autonomy and responsibility appear to increase, and they become more capable to learn independently. This finding should be taken into account while selecting and/or designing competence-based learning environments for students working in a competence-based educational programme.

25.7 Conclusions

As stated in the introduction of this chapter, the expectations of CBE are high; students would be more motivated to finish their educational programmes, and they would experience less transition problems when entering the labour market. Looking at evaluations of the implementation of competence-based qualifications framework at country level, it becomes clear that it is not sufficient to solely determine to what extent these frameworks are implemented as proxy for the effectiveness of CBE. In this chapter, it is emphasised that it is necessary to take the design of the curriculum, teaching, learning and assessment into account when trying to answer questions regarding the effectiveness of CBE. By doing so, this chapter offers educational developers concrete footholds for implementing the theoretical principles that define 'ideal' CBE. Four steps are necessary for designing effective CBE: (1) defining summative competence-based assessment programmes (CBAs), (2) identifying related practical learning situations (including supportive knowledge and skills), (3) formulating relevant personal learning questions and (4) composing corresponding learning activities and materials and putting these together in personalised learning environments. The main message of this chapter therefore is that implementing CBE is a complex process and examining its effectiveness requires studying the actual *implementation* of the CBE principles in teaching, learning and assessment activities, and specifically the *alignment* between these elements. If these aspects are not taken into account in evaluations, they will stick at the level to what extent countries or VET institutions are able to accommodate a standard set of competencies in the educational programmes, while as emphasised in this chapter, especially the operationalisation of the CBE principles to the student level makes learning in CBE a meaningful and powerful learning experience.

To finalise the mentioned standardisation-individualisation dimension of CBE should no longer be problematised; emphasis should be on activities that help teachers as well as individual students to find an effective balance between these two. This requires a certain degree of flexibility of the CBE system and should result in individualised and adaptive learning trajectories. This chapter offers ample opportunities for educational developers and teachers to consciously build this flexibility into the design of CBE curricula. The extent to which teachers and students will succeed in creating their own learning pathways will determine whether CBE will be successful for individual students, and, as a result, successful as a whole. It is to be expected that many differences will be found; study programmes and students vary, which means that conclusions about CBE effectiveness at institutional level are hardly possible, and may be meaningless, let alone conclusions at national or international level.

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Chapter 26
"4Cyourway": A Competence Framework for Measuring Competence Growth from Secondary Vocational to Higher Education and Curriculum Design

Frank P.C.M. de Jong, Hans Corten, and Cees de Jong

26.1 Introduction

Knowing is not enough. One has to be able to use what is learned in order to be successful in a job. Person and work are connected in competence (Biemans et al. 2004; Brockmann et al. 2009; Eraut 1998; European Union 2006; Hoobroeckx and Haak 2002; Van der Klink 2003; Van der Klink and Boon 2003; Lester 2005; Van der Klink et al. 2007; Le Deist and Winterton 2005; Le Deist 2009; Man et al. 2002; Van Merriënboer et al. 2002; Rauner 2007; Mulder 2007; Mulder et al. 2009; Wesselink et al. 2010). Being competent is a personal capability to mobilize and use the knowledge, skills, values, motivation, attitude, etc. to successfully accomplish a particular task in a specific context (Corten 2014). Student competence is assessed and rated in terms of the use of knowledge and skills in accomplishing tasks and goes beyond testing pure knowledge.

In the context of European mobility, Bologna Ministerial conferences in 2003 and 2005 laid the foundation for the European Qualifications Framework (EQF) and the National Qualifications Frameworks (NQF) for VET and the Dublin descriptors for higher education. In 2006 the European Commission reached a political agreement on the implementation of the "EQF-Life Long Learning" strategy in 2012. This resulted in the definition of eight levels of knowledge, skills, and competences (note the spelling of competences, which is typical for the European Commission as indicated in Chap. 1 in this volume) (http://ec.europa.eu/ploteus/content/descriptors-

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page). However, these eight levels are too general to be used in the assessment practice at school or student level. In this context it is not only the accountability aspect of (summative) assessment that is important. In the context of "assessment *for* learning," the possibility of feed forward should also be provided. Competence development crosses the boundaries of an educational level to the next level as should the feed forward, with the consequence that the framework to be developed should cover the competence development related to the different educational levels.

In Dutch vocational education, the implementation of competence-oriented learning has been a major trend during the last decades (Wesselink 2010; Biemans et al. 2004). Most students in the Netherlands choose (pre-)secondary and higher vocational education for their individual, professional pathway. Preparatory-vocational secondary schools (VMBO) form the basis of the Dutch vocational education system. By offering several learning pathways (sublevels), it aims to prepare pupils for secondary vocational education (MBO). VMBO includes an attempt to facilitate the transition to MBO and if possible HE (EP-Nuffic 2014).

MBO consists of four levels of increasing difficulty and leads either to a certificate that allows the students to enter the labor market or to start at a higher level of MBO or enter higher vocational education (HBO) (currently referred to as universities of applied sciences and professional education).

In this chapter the development and some applications of an overarching system of competence language are discussed based on a design-based study with vocational teachers and lecturers; this study is used to describe complexity levels of education programs from the diploma level of prevocational secondary education (VMBO), through senior secondary vocational education level (MBO) and bachelor degree level at universities of applied sciences, to the master degree level at the research universities. The designed framework is called "4Cyourway" (De Jong and De Jong 2008). It is a framework which displays students' competence growth from a developmental perspective.

The great eight competency framework (see Chap. 1 of this volume and Bartram and SHL group 2005) was taken as point of departure for the construction of the 4Cyourway framework. The great eight competency framework includes a set of key competencies that underpin job performance. These eight competencies are (1) leading and deciding, (2) supporting and cooperating, (3) interacting and presenting, (4) analyzing and interpreting, (5) creating and conceptualizing, (6) organizing and executing, (7) adapting and coping, and (8) enterprising and performing (Bartram and SHL Group 2005). The framework is divided into 112 more specific competencies. The framework is widely used, such as by international assessment companies. The framework was also accepted by educational institutes in the Netherlands to overcome the problems caused by the many incomparable lists of competencies used in educational practice which hinder vertical comparisons of competency statements at different levels. This is a remarkable because the framework was actually developed on manager and leadership data. The eight competencies correlate moderately with personality traits and job performance. For measuring these competencies, they can be best related to job content and context.

The 4Cyourway framework uses 11 indicators to describe the complexity levels of 25 competencies for 11 educational levels. The selection of the 25 competencies is based on that of the National Educational Institute for VET education and covers all curriculum goals of VET in the Netherlands. This set of competencies is used in all VET institutions in the Netherlands for competence-directed curriculum development and certification. An exception to this is prevocational education (VMBO), for which some competencies are irrelevant. This education sector uses 18 of the 25 selected competencies.

Although the Dutch educational system has four general levels, there are 11 intermediate levels by which students can leave the system with a graded certification. The 4Cyourway framework provides a description of every indicator for all education levels. The 4Cyourway framework uses scales that are comparable to the scales of the Occupational Information Network (O'NET) of the US Department of Labor/Employment and Training Administration. O'NET uses seven levels with descriptions of tasks that are relevant for each level. To describe one task at a certain complexity level, the 4Cyourway framework combines several indicators. The use of several indicators to describe one complexity level is in line with the arguments of Hager (2004) who concludes: "the real world practice is holistic in that it often involves simultaneously a range of performance descriptors" (see also the Chap. 10 in this volume). The 4Cyourway reference language is holistic and therefore allows the simultaneous description of several aspects of professional tasks. By holistic we mean that the indicators are intended to be used to visualize a profile instead of checking off each indicator and arriving at a total end score. The profile gives insight into what competence a student has developed him- or herself above the formal required level and where development is needed in the future. In this sense such a profile of the whole requires feed-up and feed-forward information for the particular student.

The 4Cyourway framework is a language, not yet a poem, a book, or a story. It functions as a basis for different kinds of tool or curriculum developments. In this chapter we show three cases of use, related to three research projects, to illustrate the usefulness of the framework for such tool or curriculum development. The instruments are described. Two of them are empirically validated. All three instruments are based on the 4Cyourway framework to determine students' competence growth. One example case where the framework is used in research concerns the determination of competence growth of international students at the bachelor level at a university of applied sciences. Another instrument concerns the determination of competence growth related to the carrying out of research in companies by (pre) vocational students. The third example case concerns a practical implemented instrument in school curriculum development. The later illustrates how in the context of curriculum design the 4Cyourway framework supports the building of rubrics and transparent levels that help teachers to develop and realize competence learning in their curriculum. The described cases relate to the applied university bachelor level at a university of applied sciences and on the (pre-)secondary vocational level in order to show that the framework has added value in different practical contexts

where the focus is on determination and student tools for (self-)assessment of competence growth.

The applications show that the framework is valuable because they demonstrate how the same competence terms, for instance, "planning," are given a more advanced and complex level description in relation to accomplishing a particular level of work context.

26.2 The Development of a Framework of Competence Growth

As already mentioned, the aim was to develop a competence framework which contains a transparent competence language reflecting the learnability, e.g., growth lines of competence development over the 11 Dutch vocational education levels. The reference framework should function as a basis for developing tools for (self-) assessment, showing which position a student has in his/her competence to develop from one to a next competence level. A design-based practitioner bottom-up research approach was used to develop the competence framework. Principles of the ecological transdisciplinary-inspired research approach (De Jong et al. 2013) were also used, for instance, *multidisciplinary* teams, *connection* level identification with growth and task context, and *co-creation* in and with the different teams. Not only data were gathered for the research; participants also obtained more *wisdom* in the subject during the meetings and the many subsequent workshops in which games and open-source materials which were developed were used.

26.2.1 Method

26.2.1.1 Participants

The project group which developed the 4Cyourway framework consisted of a project team of nine persons: researchers and practitioners from the different educational subsystems. During 2 years, dyads from this project team facilitated sessions with three groups of teachers (n = 30) coming from different schools and regions in the country. Each group represented two levels of the educational vocational system. Finally, there were validation meetings with teachers, educational policy officers, policy makers, and students across the country (first meeting N = 60; second meeting N = 80).

26.2.1.2 Educational Levels

The process of framework development can be characterized as empirical bottom-up practitioner's design-based and iterative research, with elements of negotiating and co-constructing.

There was a teacher group facilitated by project team members for the three connected education system levels:

1. (Lower) prevocational secondary education and senior secondary education
2. Senior secondary education and higher professional education (applied universities, including the level of associate degree and bachelor)
3. Higher professional education (Dublin cycle one) and the academic university (Dublin cycle 2, master level)

Each general system level has different sublevels and, as stated, a total of 11 educational sublevels were identified:

Pre-secondary vocational education:

1. Without qualifications but with certificates
2. Basic
3. Basic professional training
4. Theory based

Secondary vocational education:

5. Training at assistant level
6. Basic vocational training
7. Professional training
8. Middle management training

Higher vocational education (applied universities):

9. Associate degree
10. Bachelor degree (Bologna, first cycle)

University degree:

11. Master degree (Bologna, second cycle; the Bologna third cycle)

The PhD level was not included.

26.2.1.3 Competence-based Starting Framework

As mentioned above, eight key competencies and 25 more specific competencies were used as input for the framework. For pre-secondary vocational education only 18 competencies were considered relevant, which will be further explained in the description of a research project (project 3) which was conducted to develop the framework.

1. Leadership and decision
    1. Deciding and initiating action
    2. Directing
    3. Guiding
2. Supporting and collaborating
    4. Interest and understanding
    5. Collaborating and consulting
    6. Ethics and integrity
3. Interacting, influencing, and presenting
    7. Building relationships and networks
    8. Convincing and influencing
    9. Presenting
4. Analyzing and interpreting
    10. Formulating and reporting
    11. Applying expertise
    12. Allocating materials and resources
    13. Analyzing
5. Creating and learning
    14. Investigating
    15. Creating and innovating
    16. Learning
6. Organizing and executing
    17. Planning and organizing
    18. Customer focus
    19. Delivering quality
    20. Following instructions and procedures
7. Adaptation and handling
    21. Dealing with change and adapting
    22. Dealing with pressure and adversity
8. Undertaking and performing
    23. Showing drive and ambition
    24. Entrepreneurial and commercial act
    25. Commercial act

26.2.1.4 Procedure

Within design-based research methodology, interventions are conceptualized and then implemented iteratively in natural settings in order to test the ecological validity of dominant theory or to generate new theories and frameworks. Data analysis takes the form of retrospective, cross-iteration comparisons. Following a design-based methodology, the research design process included four design cycles and two broad-based field validations with many different stakeholders in VET education, e.g., from students, teachers, school directors, to policy makers.

26.2.1.5 Design Cycle 1

The objective of the teacher groups was to indicate and formulate descriptions on the basis of their practical experience-based insights for each competence and for each distinguished sublevel of the system which would be understandable for teachers. During the first session, teacher groups discussed what factors were important to deduce growth of competence. They talked about factors such as age, time, student, tasks, context, etc. It was found that they could only talk about levels or growth if they took the task context, e.g., complexity level, into consideration instead of only looking at a content level, for instance.

26.2.1.6 Design Cycle 2

Products of these groups were connected and discussed in the project team, and results were again input for the groups. By bringing the descriptions together, the project team group created a product that reflected growth of competencies over the 11 sublevels (see Tables 26.1 and 26.2).

26.2.1.7 Field Validation 1

After a year of regular co-creation sessions of the teacher groups and project team, the first growth competence frame of reference was validated in a national meeting with other teachers, educational policy officers, policy makers, and students from all over the country. In order to validate the system, a game was developed. Participants in the validation meeting played the "education column game." This education column game consists of cards with descriptions of the 11 sublevels, and the "players" place the cards in ascending order of complexity in order to validate the framework. The conclusion of this collective endeavor was that participants were enthusiastic but received the advice to redo the work because there were too many misinterpretations and consequently mistakes in the order levels.

Table 26.1 The competence valuing grid within the first column is the context factor, in the second column the growth indicator, and in each successive column, one of the eight educational sublevels for pre- and secondary vocational education

Context/criteria	Growth indicator	Pre-secondary vocational education – without qualifications/certificates	Secondary vocational education – level 1	Pre-secondary vocational education – basic	Secondary vocational education – level 2
Responsibility	Roles	x	x	X	**x**
		x	Assistant employee	X	**Employee**
		x	x	X	**x**
		x	x	X	**x**
	Responsibility	Carries out tasks under supervision	Responsible for its own actions	Preparing, carrying out, and closing	**Responsible for the tasks**
	Autonomy	Carries out tasks under supervision after clear explanation	Carries out tasks under supervision after clear explanation	Carries out tasks autonomously after clear explanation	**Carries out tasks autonomously after directed explanation**
Range	Public	Students in the classroom	I, you, and he	Students and teachers in the classroom	**Contacts in the working environment**
	Timeline	Hours	Hours	Days	**Days**
Complexity	Tasks	Simple subtasks	Simple tasks	Simple set of tasks	**Simple set of tasks**
	Procedures	Routine reproduction	Routine reproduction	Routine reproduction	**According to standard procedures**
	Knowledge and understanding	Knows relevant definitions	Knows functional facts	Knows relevant definitions	**Knows facts and is able to understand simple explanations**
Transfer	Ambiguity	Transfer in steady context	Transfer in stable context	Transfer in steady context	**Transfer in related context**
	Change	Changes under supervision	Changes after instruction	Is able to manage oneself in a well-known environment	**Is able to manage oneself in a well-known environment**
	Range	**Is able to transfer within the tasks**	**Is able to transfer within the area of tasks**	**Is able to transfer within a profession**	**Is able to transfer within a profession**

Responsibility	Roles	x	Autonomous professional	x	Specialized professional
		x	Foreman	x	Middle manager in a small organization
		x	Sole trader	x	Entrepreneur SME
		x	x	x	x
	Responsibility	Responsible for the full cycle of doing tasks, including reflection	Responsible for a team or a project	Responsible for the full cycle of doing tasks, including reflection on the tasks done by others	Responsible for one or more teams, projects, or a company
	Autonomy	Carries out tasks autonomously, entrepreneurial	Carries out tasks autonomously in deliberation	Carries out tasks autonomously, entrepreneurial	Has a mandate to carry out tasks autonomously and show initiative
Range	Public	Students and personnel in the year of their study program	Colleagues and customers	Students and personnel in the school	All employees and regional contacts of the company
	Timeline	Weeks	Weeks	Months	Months
Complexity	Tasks	Several tasks in the same time	Combinations of tasks	Schedules combinations of tasks	Combines and coordinates tasks
	Procedures	Basic, explorative, productive	Is able to adjust standard procedures	Orientation, exploring, productive	Adjusts and improves procedures
	Knowledge and understanding	Knowledge of facts and methods; applying knowledge in concrete situations	Knows facts and methods and is able to explain	Knows facts and methods and is able to apply knowledge in practical situations	Knows facts, methods, and principles; is able to formulate arguments, to analyze; and is able to transfer knowledge and skills

(continued)

Table 26.1 (continued)

Context/Criteria	Growth aspect	Pre- secondary vocational education – management occupation	Secondary vocational education – level 3	Pre-secondary vocational education – theory based	Secondary vocational education – level 4
Transfer	Ambiguity	Transfer in situations with limited changing factors	Transfer in situations with several changing factors	Transfer in a dynamic context	Transfer in complex and hard to predict factors
	Change	Is able to adjust oneself	Is able to adjust the tasks in changing situations	Is able to introduce changes	Is able to direct changes, to initiate changes, to come up with new ideas for changes from practice
	Range	Is able to transfer within the sector	Is able to transfer within a profession	Is able to transfer between sectors	Is able to transfer within the sector

A description of the level is given in each cell

Table 26.2 The competence valuing grid within the first column is the context factor, in the second column the growth indicator, and in each successive column, one of three educational sublevels for higher vocational education

Context/criteria	Growth aspect	Higher vocational education – associate degree	Higher vocational education – B(Sc) degree	University degree – M(Sc)
Responsibility	Roles	Specialist, policy officer	Researcher	Researchers, consultant, developer
		Operations manager	Policy maker	Governor, policy decision maker
		Entrepreneur	Innovative entrepreneur	Knowledge-intensive entrepreneur
		x	Teacher	Teacher
	Responsibility	Responsible for one or more teams, projects, or a company	Responsible for one or more teams, projects, or a company	Responsible for the strategy, vision, and coordination of programs
	Autonomy	Fully responsible for carrying tasks and shows initiative	Fully responsible for carrying out tasks and shows initiative	Independent in the way they think and act
Range	Public	Employees, national contacts of the company, critical customers, government, and NGOs	Employees, national contacts of the company, critical customers, government, and NGO	Diverse people, from layman to specialists
	Timeline	1 to 5 years	5 to 10 years	Next generation; 10 to 30 years, historical awareness and being able to deal with the short term and longer term constraints

(continued)

Table 26.2 (continued)

Context/criteria	Growth aspect	Higher vocational education – associate degree	Higher vocational education – B(Sc) degree	University degree – M(Sc)
Complexity	Tasks	Has an overview of the consequences of his own work and the work of others	Is able to analyze the work that has to be done in several tasks	Has an overview and understands the complexity and diversity of tasks
	Procedures	Develops new procedures	To innovate is a basic strategy	Methodically and systematic analyzing
	Knowledge and understanding	Knows facts, methods, and principles; is able to formulate arguments, to analyze, and to deliberate; and is able to transfer specialist knowledge and skills	Combines facts, methods, and principles; is able to integrate different disciplines, to formulate arguments, to analyze, and to deliberate; and is able to design methods to transfer knowledge and skills	Develops new theories, concepts, and models
Transfer	Ambiguity	Transfer in complex and hard to predict factors	Transfer in continuously changing contexts	Integrates different contexts, making use of temporary, societal, and social-cultural aspects
	Change	Is able to manage changes and to complete changes	Is proactive, comes first with new ideas, and is able to design changes	Is able to develop new concepts and takes the lead in realizing change
	Range	Is able to transfer in related sectors	Is able to analyze related sectors and to relate these different sectors	Is able integrate different disciplines, develops from another discipline, and takes care for synergy

A description of the level is given in each cell

26.2.1.8 Design Cycles 3 and 4

During the second year, teacher groups and project team went through the whole process of co-creating meetings once more. Presentations were given at a conference to obtain feedback from the research community as well as from teaching staff in schools in order to obtain more external feedback.

26.2.1.9 Field Validation 2

At the end of the second year, the next national validation meeting was held. This time we validated the level descriptions in two ways, first by playing the education column game and secondly by having students from different educational levels present their examination work for 15 min. After the presentation the students were questioned in depth by groups of 4–5 participants from two system levels who after questioning indicated the level of the students. The student also made a self-indication. The result was first that the diagnosis between the different participants was very similar even with the self-diagnosis of the student. A second result was that the diagnosis showed not only if the student had mastered a particular educational level, but it also offered a profile for which aspects he/she had mastered at a higher or lower level.

During this field validation, the 4Cyourway system proved to be a good base for feed forward. For instance, one discussion with a student resulted in the advice to further his studies in higher education because several of the competencies he had already mastered were a sublevel higher than expected. This student had never considered further study because he always had the impression he was not good enough. This therefore gave him a perspective for a further step crystallized in his saying that "*I feel you have a better view of my competence than my own teachers*."

Researchers checked the agreement between the competence reference framework with the Dublin descriptors cycles 1 and 2.

26.2.2 Results

26.2.2.1 The Competence Valuing Grid

Two main products were obtained from the design-based research. The first one is a basic competence valuing grid (see Tables 26.1 and 26.2). We talk about valuing to emphasize the development-oriented perception, assessment *for* learning, for going beyond an accountability perception of only checking if students meet a particular required level of development, e.g., assessment *of* learning. This competence valuing grid consists of four context factors: responsibility, range, complexity, and transfer. It also consists of 11 growth indicators related to the context factors:

- Responsibility: The role somebody has to take; his responsibility; his autonomy.
- Range: Public, timeline (planning scope).

- Complexity: Task, procedures, knowledge, and understanding.
- Transfer: Ambiguity, change, range

Together with the 11 educational sublevels, this makes up 121 cells, e.g., core indicator descriptions of competence level growth. The grid was used by CINOP, an institute in the Netherlands concerned with the construction of NQF and EQF input from the Netherlands.

Tables 26.1 and 26.2 show the grid with in the first column the context factors and in the second column the 11 growth indicators. In the following columns, the different sublevels of the educational VET system (a total of 11) are given. Short descriptions of the level are given for each cell.

26.2.2.2 Competence Detail Description Sheets

In addition to the grid, the design project resulted in a second product. This product is an elaboration of the grid into a series of 275 rubric sheets for each of 25 competence descriptions for each of the 11 sublevels (for an impression of this, see Figs. 26.1a and 26.1b). A more detailed description of the competencies is given in the

MBO 4 (secondary vocational education)	**R roles**	**R responsibility**	**R independency**	**Ra public**	**Ra timespan**
	specialized craftsman, middle management of a small business, entrepreneur SMEs	responsible for one or more teams, projects or company	work independently on the basis of mandate / initiative	all staff and regional corporate contacts	months
Planning and organizing I coordinate and advise the organization on the deployment of personnel, equipment and materials based on a schedule for one or more months. I predict the progress based on results and set priorities for unforeseen circumstances to achieve the planned objectives.					
C work	**C procedures**	**C knowledge and understanding**	**T ambiguity**	**T changing**	**T scope**
combines and coordinates tasks	adjust sand improve procedures	knowledge of facts, methods and principles; may prepare / analyse arguments; can teach knowledge and skill	transfer in situations with complex / unpredictable factors	can also give direction to change, can initiate changes, ideas for change can be obtained from practice / performance	transfer within context of the sector

Fig. 26.1a An example of an elaborated detailed competence description sheet for secondary education level 4, for the competence "planning and organizing." In the middle (*dark gray*) the competence is described. In the *top left* corner, the educational level is indicated. The first and fourth rows (*middle gray*) indicate the context factors *R* responsibility, *Ra* range, *C* complexity, and *T* transfer. A specific level description related to the context factor is given in the cells. If a cell is colored light *gray*, then that particular context factor is indicated by experts as an important indicator that makes the difference for this particular competence

HO B(SC)	V roles	V responsibility	V independency	R public	R timespan
	1) researcher, consultant, developer, 2) policy-developing manager, 3) innovative entrepreneur.	responsible for one or more teams, projects or the organization	works independently at their own risk, based on their own initiative	employees, international business contacts, critical public, community groups, governments	long term 5-10 years
Planning and organizing I plan activities, people, resources and materials for the development of the organization, the environment and changing conditions over one or more years (5-10).					
C work	**C procedures**	**C knowledge and understanding**	**T ambiguity**	**T changing**	**T scope**
can break down the complexity of the work in various facets	innovation is a basic strategy	combining facts, methods and principles can integrate different areas of knowledge; may develop arguments, analyse weigh; transfer methods can design and customize	transfer in constantly changing conditions	is proactive to change, forefront, can design changes	Inter-sector, across sectors can look back and can establish relationships between sectors

Fig. 26.1b An example of an elaborated detailed competence description sheet for higher education level for the competence "planning and organizing." In the middle (*dark gray*) the competence is described. In the top left corner, the educational level is indicated. The first and fourth rows (*middle gray*) indicate the context factors *R* responsibility, *Ra* range, *C* complexity, and *T* transfer. A specific level description related to the context factor is given in the cells. If a cell is colored light gray, then that particular context factor is indicated by experts as an important indicator that makes the difference for this particular competence

center. The description is surrounded by descriptions of the 11 growth indicators at that particular level. Color growth indicators mean that these growth indicators are the most meaningful for this particular competence. The latter was the result of very high agreement in a multidisciplinary team of experts, teachers, and researchers where growth indicators are more meaningful in relation to the competence described.

26.2.3 Reflection: First Impression of the Usability

The design research project described above resulted in a competence description framework reflecting the growth of a competence development across 11 educational levels. At all levels the same competencies are used, for instance, that somebody is able to plan, which means different actions and different expectations for each level. This may look like an open door, but we did not encounter any other system in our literature search that was as compact and covered so many

competencies and so many levels with descriptions in a language that teachers understand. In workshops with the education column game but also with a second "matching game," we noticed that the framework enables teachers and others to talk about competencies in a transparent way without ending up in discussions about competence definitions, but that aids an understanding of how competencies develop or grow over the different educational levels. When working with the matching game, workshop participants obtain an even better insight into the frictions when students transfer from one system level or subeducational level to another.

In the matching game, teachers work in two groups related to two educational levels. First, one group indicates as "supplier of a student" to a moving up level and the other group as "receiver of a student of a pre-level" the expected competence level by selecting the ten most critical competencies and their level description. This is done on transparencies. Secondly, the transparencies of both groups are placed on top of each other. This means you can see the results of both selections immediately, and it is directly visible where there is a match or mismatch between expected competence and the competence level. Experience with many of these workshops shows the meaningfulness of the developed competence reference/growth framework. Its meaningfulness can also be derived from the fact that teachers in the workshops became aware that some of their learning tasks were at a totally too low or too high level. They have started to use the framework to adjust the learning tasks to support students to move from one educational level to another. The framework is a valuable addition to existing knowledge on competence levels.

Others have started to think about using the framework to develop more concrete assessment tools. In the next section we look at the usefulness of the framework in the context of research where the framework was used to develop questionnaires based on self-diagnosing instruments.

26.3 Usability of the 4Cyourway Framework

In the years after the project, the project products were available as an open source. Several VET practitioners used the products to develop tools for curriculum development or as research instruments to determine competence growth. The authors were involved in three projects which also used the 4Cyourway framework to develop instruments. These projects were selected because of their quality and longitudinal nature. The project described first was part of PhD research. The second project concerned a 3-year research project in the context of a school reform in collaboration with the schools. The last project involved long-term collaboration and implementation of the research project in and with schools.

26.4 Research Project 1: Measuring Competence Growth in Higher Education on the Basis of the 4Cyourway Framework

Based on the 4Cyourway framework described above, a self-assessment questionnaire was developed (Corten et al. 2015b) to measure the competence development of students in the final year of a bachelor program. This instrument was used to compare the competence development of groups of students in several countries.

26.4.1 Method

26.4.1.1 Participants

Nine students who were about to graduate (B-level students) participated in a cognitive lab. Experienced assessors of competencies carried out the expert assessment. These ten experts were not involved in the item development.

The pilot study consisted of 228 students of whom 120 were students at the start of the final year of a bachelor program (S-level students) and 108 were students at the end of the final year of a bachelor program and about to graduate (B-level students). A total of 263 students studying in five countries took part in a longitudinal study (the Netherlands, Latvia, Poland, Hungary, and France).

26.4.1.2 Instrument

Items were designed with task descriptions on three complexity levels. The description of the items was made by a specialist in competence-based learning and senior assessors at the university of applied sciences involved. First items with task descriptions were at bachelor level (B level) of which it was expected that students at the start of the final year of a bachelor program would not have accomplished these tasks, while students at the end of the final year of a bachelor program would have accomplished these tasks. As it was not clear how well the 11 criteria describe the complexity level at bachelor level, items were also developed with task descriptions at the start (S) level of the final year of a bachelor program and items with task descriptions at master (M) level. The hypothesis was that all students would have accomplished the tasks described at the start level and no students would have accomplished tasks at the master level. Each item was developed with the idea that accomplishing this task required mainly one specific competence. We used four competencies to develop and test the pilot instrument: to cooperate, to organize, to present, and to self-direct.

The complexity levels of the task descriptions were operationalized with 11 level indicators (see this chapter and De Jong and De Jong (2008)), and a task is described in such a way that one level indicator is used for each task description. In this way there are 11 task descriptions for each complexity level (S level, B level, M level) of

each competence. Table 26.3 gives an example of three items at three levels for the competence "to organize" with level indicator 1: role.

This meant developing at least 11 (indicators) * 3 (levels) * 4 (competencies) = 132 items. However, for some level indicators more than one professional (sub)task was described for reasons of multiple interpretation. In total 151 task descriptions were included in the further development of the instrument.

Every item was formulated in the past simple tense, for example, "I made/did/organized" so that the respondents had to verify whether they actually accomplished this task. The answer categories were therefore "yes" (accomplished) and "no" (not accomplished).

The expertise level (Lester 2005) was operationalized by asking the participants to indicate the experienced ease of having accomplished a task on a five-point Likert scale from easy (1) to difficult (5). Table 26.4 gives an example of the questionnaire.

26.4.1.3 Procedure: Three Design/Validation Cycles

The design/validation process consisted of three cycles:

1. *Cognitive lab*: As a first step in the developed questionnaire, the comprehension of the items was evaluated in a cognitive lab (Johnstone et al. 2006). Items that fall short were removed from the questionnaire.
2. *Expert validation*: The second step of the design/validation strategy was an expert validation of the item-competence match. There was an item-competence match if at least eight of the ten experts (80 %) assigned the same competence to

Table 26.3 Example of items developed for the competence "to organize" with level indicator 1: role

Level	Item description
Start	I made a plan for a group assignment and coordinated the implementation
End	I made the plan for a project in which several people were involved
Master	I develop new methods to measure and optimize things

Table 26.4 Example of Questionnaire

			Yes			Yes	
			Difficult			Easy	
1	I made a plan for a group assignment and coordinated the implementation	No	1	2	3	4	5
2	I formulated clear deadlines for a team or an organization	No	1	2	3	4	5
…							
149	I organized a change process in response to social developments	No	1	2	3	4	5

an item. Other items were removed from the questionnaire. To replace the removed items, additional items were developed which were also subjected to the expert assessment.

3. *Pilot study*: The third step of the design/validation strategy was a pilot study among students to select discriminating items. We used three criteria to select discriminating items:

    1. There is a significant association between the year of study and whether or not the students completed a task as described in the item.
    2. The absolute percentage of B-level students that accomplished the task is at least 15% points higher than S-level students.
    3. B-level students find the task significantly easier than S-level students.

26.4.2 Results

26.4.2.1 Cognitive Lab

The cognitive lab showed clearly that the participants did not understand 19 of the 151 items (13 %). These 19 items were removed from the questionnaire. To increase the comprehension of the items, the participants suggested changes in the description of 45 items.

26.4.2.2 Validation by Experts

For 122 of the 151 items (81 %), at least 80 % agreed with the item-competence match. The other 29 items were removed from the questionnaire. Of these 29 items, four items were also removed from the questionnaire as a result of the cognitive lab, and 107 items were kept.

Content experts also validated additional new developed items on the item/competence match, which resulted in an additional 42 new items to be included in the test questionnaire. The questionnaire for the pilot study therefore consisted of 149 items.

26.4.2.3 Pilot Study Among Students

For 58 of the 149 items, there was a significant association ($\chi^2 = 2.86–13.00$; $p < .05$) between the group of participants (S-level students and B-level students) and whether or not students accomplished the task as described in the item.

Of these 58 items, the answers of 47 items showed that between the S-level group and the B-level group, there was more than 15 % point difference in the percentages of respondents who answered that they accomplished the task. These 47

items met the first two criteria and were selected for the self-assessment instrument.

Of the remaining items, there were nine items for which less than 33 % of the students answered that they accomplished the task and are probably items at master level. Seven of these nine items were designed at master level and are also included in the questionnaire.

For the 56 items, the reliability for each competence scale was calculated by Cronbach α: "to organize" (α = .85), "to present" (α = .77), "to cooperate" (α = .75), and "to self-direct" (α = .70).

26.4.3 Conclusions of Research Project 1

The results show that it is possible to develop an internal and external reliable competence self-assessment questionnaire by describing professional (sub)tasks using the 4Cyourway-language in such a way that mainly one specific competence is needed to accomplish such a hypothetical task.

The results of the pilot study show that it is possible to describe the complexity level of a task using only one indicator in such a way that reliable scales for the four competencies distinguish the competence level of students at the start and end of the final year of a bachelor program.

The developed instrument can measure differences in the complexity level of competence, but the five-point scale used is not sensitive enough to measure the experienced difficulty level of the competence.

The fact that the instrument measures the difference in competence level as a result of 1 year of study implies that the instrument is sensitive for competence development. In a follow-up study, a significant increase in competence level for all four competencies for students in five countries was determined. In the same study, the competence levels of the students in the Netherlands were also confirmed by lecturers who assessed the competence levels in other ways (e.g., observations, portfolio) (Corten et al. 2015a). And last but not least, this study determined a significantly higher competence development for all four competences for international students who studied on a competence-based program in the Netherlands as compared to their peers who followed a knowledge-based program in their home universities in Latvia, Poland, Hungary, and France. The follow-up study showed a small decrease of the Cronbach α. The reliability of the scales for the competencies "to organize" (α = .81) and "to present" (α = .74) was still good. The scale for the competence "to cooperate" (α = .65) was reasonable. The scale for the competence "to self-direct" was weak (α = .57) but becomes reasonable (α = .60) after deleting two items (Corten et al. 2015a).

The instrument is freely available for use (Corten 2014).

26.5 Research Project 2: Measuring Competence Growth in (Pre-)secondary Vocational Education on the Basis of "4Cyourway" Framework

On the basis of the competence reference framework described above, a questionnaire was developed (De Jong, in preparation) that was used in a reform context to measure the competence growth of students over a period of 2 years. In a reform "green lyceum" pre-secondary and secondary education was merged together to form a lyceum trajectory of 6 instead of 7 years. In the reform a 3-year project took place in which students carried out research in companies in order to obtain practical experience. In order to determine whether students developed related competence, the growth was measured by a quasi-experimental control group repeated measurement design. The study followed the ethical research guidelines of the Netherlands Educational Research Association.

26.5.1 Method

26.5.1.1 Participants

The data analysis concerns 79 (pre-)secondary vocational students of the green lyceum – comparable to comprehensive school but more practically oriented in the domain of agriculture and food. Forty-nine students came from two schools participating in the project and carried out one-day research for a company, and 30 students belong to two schools not participating in the project. The latter are therefore used as a reference group. The age of the students was about 14.9 years (sd, 0.9). There was no difference between age and gender between the groups.

26.5.1.2 Instrument

A competency questionnaire was developed on the basis of the 4Cyourway competence reference framework by elaborating the competence descriptions into context-level rubrics (Table 26.3). When students filled in the questionnaire, they were asked to indicate what context description applied to them. The rubrics represent different levels (levels at the end of the study routes, secondary vocational sublevels 2, 3, and 4). In total, the competency questionnaire consists of 96 questions. Each competency student answered 12 questions for each of the following eight competencies: Collaborating and consulting (Cronbach $\alpha = .83$), investigating (Cronbach $\alpha = .83$), planning and organizing (Cronbach $\alpha = .85$), formulating and reporting (Cronbach $\alpha = .89$), dealing with pressure and adversity (Cronbach $\alpha = .92$),

analyzing (Cronbach α = .88), deciding and initiating (Cronbach α = .91), and presenting (Cronbach α = .9).

26.5.1.3 Procedure

Three measurements were taken at the start of January of the second project year with a paper and pencil form. Students also filled in the questionnaire online in December of that same year and in June of the following year. This means a measurement at the beginning and end of each period in which a student had carried out research for a company.

26.5.2 Results

A MANOVA was carried out with a between factor "yes/no green lyceum" and two within factors time, with three variates, and competence with eight variates. Because Mauchly's test of sphericity was significant for the main effects time and competence and one interaction time x competence, the corrected values of Greenhouse Geisser are used in these cases. A multivariate effect was found for the within factor time (F = 55.288 (df 1.74,133.961); P < 0.000; Eta = .418; Power = 1) and competence (F = 18,134 (df 5.883,452.97); P < 0.000; Eta = .191; Power = 1). Also all three first-order interactions were significant time x "yes/no green lyceum" (F = 9.97 (df 2,76); P < 0.000; Eta = .208; Power = .981); time x competence (F = 4,8 (df 14,1811.258); P < 0.000; Eta = .059; Power = 1); time x competence x "yes/no green lyceum" (F = 1.986 (df 14,64); P = 0.033; Eta = .303; Power = .905). This last interaction is most interesting and in the favor of the students who participated in the project (see Fig. 26.2a and 26.2b).

26.5.3 Conclusions of Research Project 2

From this study we can conclude that it is possible to develop a questionnaire on the basis of the 4Cyourway competence reference framework sensitive enough to determine the difference in competence growth between a group of students following a curriculum where no project ran with the focus on developing "research competence" and where competence is becoming more prominent in the last 2 years of the curriculum and experimental schools participating in a project in which students carried out research for a company one day a week during a 3-month period.

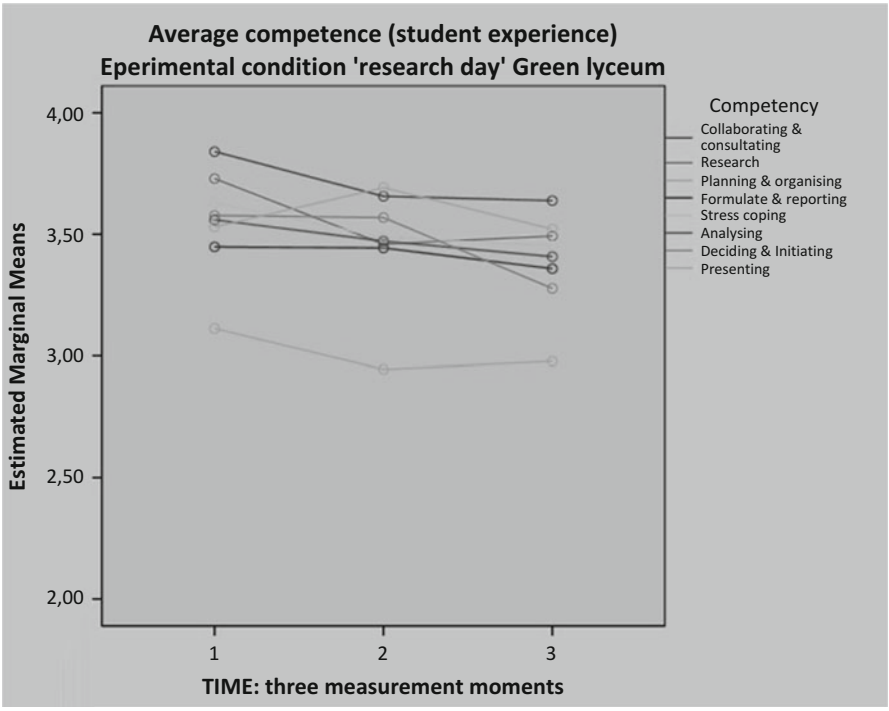

Fig. 26.2a Interaction time x competence for experimental group

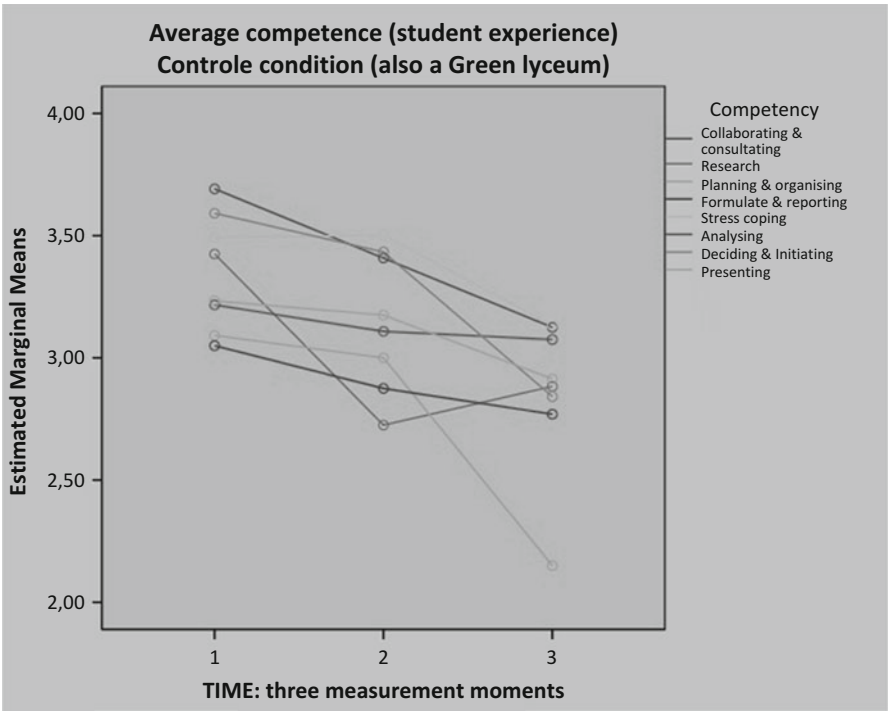

Fig. 26.2b Interaction time x competence for experimental and control group

26.6 Research Project 3: The Reference Framework for Practice – Impact and Use of the 4Cyourway Framework in the Context of the Development of Competence-oriented Prevocational Education

This section of the chapter looks at the impact and practical use of the 4Cyourway framework in prevocational education in life science programs. After introducing competencies in universities of applied sciences and secondary vocational education (MBO), it was logically only a matter of time before competence-oriented education was implemented in prevocational education (VMBO); this was actually during the last decade. It was particularly introduced in programs on life sciences in VMBO. In total 18 competencies were selected from the MBO set of 25 competencies (Bartram and SHL Group 2005) (Table 26.5). The average young ages (12–16 years of age) and limitations in possible roles of the VMBO students in practical settings, for example, during apprenticeships in companies, are the main reasons for the irrelevance and exclusion of certain competencies. However, all the abovementioned factors of the MBO set are represented in the selection for VMBO.

After the introduction and open-source availability of 4Cyourway "basic competence appreciation grid" (Table 26.1 and 26.2) and the 25 "competence descriptions" for each of the 11 sublevels (see Figs. 26.1a and 26.1b) in vocational education, it was found that VMBO professionals had a need for more "ready to use" applications. In particular, the need for an easy-to-use competence growth measurement instrument was expressed, instruments that also support the organization of competence-oriented learning and formative and student self-assessment. The combination of VMBO and MBO in this process supports the realization of continuous learning, e.g., a smooth transfer from VMBO to MBO.

26.6.1 Method

26.6.1.1 Participation

In 2009 a group of eight VMBO schools with life science programs was formed to develop and test useful practical tools for measuring competence growth. The group consisted of teachers and middle managers and was coached by a national advisory institute for educational development and advice CPS. A group of six MBO schools also participated in the development of such an instrument.

26.6.1.2 Procedure

At first the brief general descriptions of the 18 competencies of 4Cyourway of the four sublevels of VMBO were translated into the everyday language of pupils and their VMBO teachers. Simultaneously together with six MBO schools, the descriptions of the four subsequent MBO levels also were translated.

Table 26.5 Sets of competencies in the programs of life sciences in secondary (MBO) and pre-secondary vocational education (VMBO)

Factors	MBO (25) Secondary vocational education	VMBO (18) Pre-secondary vocational education
Need for power and control **Leadership and decision**	01 Deciding and initiating action	01 Deciding and initiating action
	02 Directing	
	03 Guiding	
Agreeableness **Supporting and collaborating**	04 Indicate attention and understanding	
	05 Cooperation and consultation	05 Cooperation and consultation
	06 Acting ethically and with integrity	06 Acting ethically and with integrity
Extraversion **Interacting, influencing, and presenting**	07 Building relationships and networks	07 Building relationships and networks
	08 Persuading and influencing	
	09 Presentation	09 Presentation
G-factor (general intelligence) **Analyzing and interpreting**	10 Formulation and reporting	10 Formulation and reporting
	11 Applying expertise	11 Applying expertise
	12 Applying materials and resources	12 Applying materials and resources
	13 Analyze	13 Analyze
Openness for new experience **Creating and learning**	14 Researching	14 Researching
	15 Creating and innovating	
	16 Learning	16 Learning
Conscientiousness **Organizing and executing**	17 Planning and organizing	17 Planning and organizing
	18 Address the needs and expectations of customers	18 Address the needs and expectations of customers
	19 Deliver quality	19 Deliver quality
	20 Follow instructions and procedures	20 Follow instructions and procedures
Emotional stability **Adaptation and handling**	21 Dealing with change and adapting	21 Dealing with change and adapting
	22 Dealing with pressure and adversity	22 Dealing with pressure and adversity
Need for achievement **Undertaking and performing**	23 Show drive and ambition	
	24 Act in an entrepreneurial and commercial manner	
	25 Act commercial	25 Act in a commercial manner

Secondly, rubrics for each competence were developed. For all 18 competencies, three underlying behavioral development steps (started, practiced, advanced) were added to each target level.

Thirdly, all these practical descriptions were tested and adopted with teachers and students. Evaluations showed that the composite behavior sentences in the rubrics proved to be abstract and not approachable enough for the pupils. In order to facilitate pupils in self-measuring their competence growth, composite behavior sentences were replaced by single-behavior sentences (see Tables 26.7 and 26.8 for an example). This operation was carried out for all competencies in VMBO for all sublevels of VMBO in collaboration with the responsible teachers and middle managers of the original group of VMBO schools.

26.6.2 Results

26.6.2.1 Product

The project resulted in competence rubrics of all competencies for both VMBO and MBO for all sublevels, based on the competence descriptions of 4Cyourway (competence cards (De Jong 2010a, b) (see Table 26.6 for an example). The majority of VMBO schools with life science programs use the rubrics in order to measure competence growth in everyday practice of prevocational education.

26.6.2.2 Practical Impact 1

The improvement of the rubrics into single composite behavior sentences proved to be a major step for self-measuring competence growth by VMBO pupils (see Tables 26.7 and 26.8 for an example).

26.6.2.3 Practical Impact 2

In everyday school practice, the number of persons for measuring competencies is limited. According to Gulikers and Mulder (2013), objectivity is better guaranteed with three assessors rather than one. In the majority of VMBO schools, competence is currently assessed by the student, the responsible teacher, and a third person (i.e., workplace trainer, another teacher, or senior pupil). The rubrics supported the objectivity of these assessments by making them transparent by means of visualization (see Fig. 26.3).

Table 26.6 Competence card for competence planning and organizing (Q) for three sublevels VMBO (*BB* basic vocational program, *KB* advanced vocational program, *GT* combined theoretical program) and three subsequent sublevels MBO (*MBO 2* basic vocational training, *MBO 3* professional training, *MBO 4* middle management training)

Competence	Planning and organizing (17)			
Sublevel	Started	Practiced	Advanced	Target level
BB	I need help in organizing and planning my daily activities	I organize and plan my daily activities and get help in predicting whether I will finish them in time	I organize and plan my daily activities by myself and mostly stick to these daily schedules	I organize and plan my daily activities in consultation with a group. I keep to this day planning and adjust as necessary
KB	I need help in organizing and planning my daily and weekly activities	I organize and plan my daily activities by myself. I need help with my weekly schedule and with predicting whether I will finish the work in time	I organize and plan my daily and weekly work myself and usually I keep to this planning. Sometimes I tell others what they can do better next time	I organize and plan my weekly work, also in agreement within a group. I keep to this weekly schedule and adjust it when necessary. I indicate what I and other persons can do better next time
GT	I organize and plan my daily activities itself. I need help with my weekly and monthly schedules and with predicting whether I will finish them in time	I organize and plan my daily and weekly activities by myself and mostly I keep to this planning. I need help with my monthly schedule. I tell others what they can do better next time	I organize and plan my weekly activities, also in agreement within a group. I keep to this weekly schedule and adjust it when necessary. I clarify what I and other persons can do better next time	I organize and plan my weekly/monthly activities, in agreement within a group. I keep to these schedules and adjust them if necessary. I report what I and other persons can do better next time. I write proposals to correct this permanently
MBO 2	With help I prepare my work for each component. I perform my duties mostly in the correct order. With help I succeed to carry out the work within the agreed time	I usually need help to prepare my work for each component. I perform my duties mostly in the correct order. Another person sometimes helps me to carry out the work within the agreed time	I occasionally need help to prepare my work. I perform my tasks in the correct order, within the agreed time. I usually report well-timed when the work will not be ready in time. I sometimes correct my planning when necessary	I prepare my own work. I will perform my tasks in the correct order and within the agreed time. I report well-timed when the work will not be ready on time. If necessary I correct my planning

(continued)

Table 26.6 (continued)

Competence	Planning and organizing (17)			
Sublevel	Started	Practiced	Advanced	Target level
MBO 3	I prepare my daily work and perform my tasks in the correct order. I occasionally need help with my weekly planning. I write down when I must complete my tasks and timely indicate if the work will not be ready in time	I prepare the activities of myself and my colleagues in time, so we can move forward with our work. I monitor the weekly planning and occasionally make proposals to adjust the activities so the work can be finished in time	I recommend in a project in which I am participating on the use of people of my team, resources, and materials based on a schedule for several weeks. I monitor the weekly planning and make proposals to adjust the activities so the work can be finished in time	I coordinate a project in which I am participating on the use of the people of my team, resources, and materials based on a schedule for several weeks. I monitor the multiple week planning and adjust it as necessary in order to complete the work in time
MBO 4	Within a project I ensure, during the preparation of the work, that my colleagues and I can move forward. I explain the weekly planning and indicate in a timely manner if the work will not be ready in time	In a project in which I am participating, I make recommendations on the use of people of my team, resources, and materials based on a schedule for several weeks. While I monitor the progress, I occasionally make proposals to adjust the activities so the goals can be achieved in time	I coordinate a project or team with regard to the use of people, resources, and materials. I realize the planning for several weeks. I monitor daily and weekly progress and make reports of the progress. If necessary I adjust the planning in order to achieve the goals in time	I coordinate one or more projects or teams with regard to the use of people, resources, and materials. I realize the planning for one or more months. I monitor the progress of the project. I suggest and qualify priorities for unforeseen circumstances in order to achieve the planned objectives in time

De Jong (2010a, b)

Table 26.7 Rubrics for the competence Q: planning and organizing for the basic level of VMBO in composite behavior sentences. Notice that the description is in composite behavior sentences

Competence	Planning and organizing (17)			
Sublevel	Started	Practiced	Advanced	Target level BB
BB	I need help in organizing and planning my daily activities	I organize and plan my daily activities and get help in predicting whether I will finish them in time	I organize and plan my daily activities by myself and mostly I stick to these daily schedules	I organize and plan my daily activities in consultation with a group
				I keep to this day planning and adjust as necessary

Table 26.8 Rubrics for the competence Q: planning and organizing for the basic level of VMBO in single-behavior sentences

Competence	Planning and organizing (17)			
Sublevel	Started	Practiced	Advanced	Target level BB
BB	I get help in planning of my daily activities	I ask assistance in planning of my daily activities	I usually plan my own daily work	I plan my daily activities independently
	I mention the necessary tools and materials	I make a list of necessary tools and materials independently	I usually bring the right tools and materials for use at the appointed workstation	I bring the right tools and materials for use at the appointed workstation(s)
	I commit to working hours	I commit to working hours	I commit to working hours	
	I work in the agreed workplace	I work on the agreed workplace	I stick to my plan and ask for help when I get delayed	I stick to the agreed task(s), working and planning
	I get help to keep my planning	I ask assistance to keep my planning	I write down the bottlenecks in my schedule and tasks	I adjust my work schedule and task(s) (in consultation) as needed

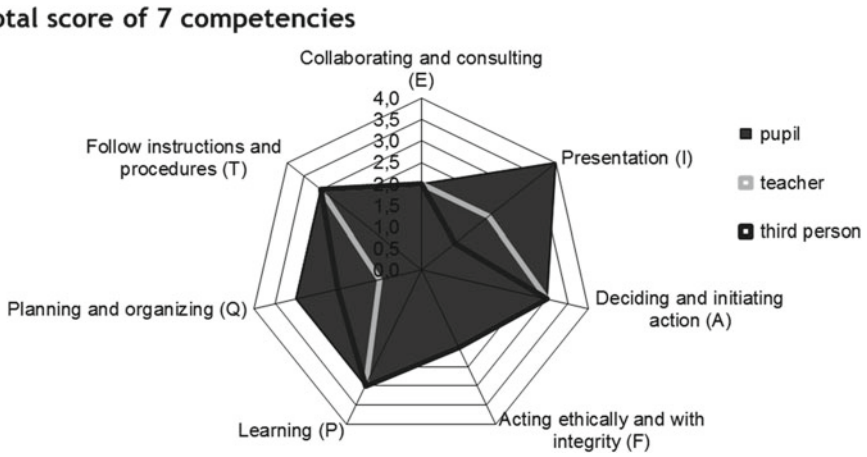

Fig. 26.3 Example of registration of seven competencies by three persons. Notice the agreement in appreciation for the competencies A, E, F, P, and T and the (significant) differences in the appreciation for the competencies I and Q

26.6.3 Conclusions of Project 3

The visualizations by which differences between assessors (e.g., student (self-assessment), teacher, and a third person) became more apparent supported reflective conversations after the final appreciation of competence growth is determined; this leads not only to feedback but also to feed forward (tips and tops) and assignments for the next period. The student's self-assessment and visualization helped him or her to participate in these reflective conversations and make better decisions for further learning.

In order to measure competence growth, it is absolutely necessary to organize regular moments for reflective conversations with the pupils in the official school schedules. Some schools have weekly moments, while others organize project weeks in which projects are completed and competence growth is measured.

With the competency rubrics, teachers were better able to match the level of the students in their lessons, practical assignments, and also in tests and assessments. The descriptions of 4Cyourway, translated into competency rubrics for VMBO (and MBO), clarified the differences between the pathways in VMBO (and MBO). The development steps in the rubrics made teachers aware that some in-school learning arrangements were not always adequate to obtain outcome levels for a number of competencies. To reach the outcome level, the learning arrangement was (within the capabilities of the schools) extended to practical authentic learning arrangements outside school (van der Schaaf 2010). Schools became more aware of the importance of authentic learning arrangements in the curriculum of life science programs in developing student competence level.

26.7 Overall Conclusions

The 4Cyourway competence framework is an empirically based framework. It helps teachers to talk about the content of competencies without losing themselves in discussions about definitions of the concept of competence. It supports constructive dialogue about competence development.

The research conducted showed that it is possible to develop a competence questionnaire to diagnose differences in the perceptions of students at different periods of time in which the development of competence-orientation took place. In the study concerning international students who studied on a competence-based program in the Netherlands, all four measured competence raised as compared to their peers who followed a knowledge-based program in their home universities in Latvia, Poland, Hungary, and France. These differences could even be determined to years later when students were working in a job (Corten 2014). The method of student self-perception questionnaire to determine competence differences between groups also worked in secondary VET education as study 2 showed.

It was found that even in prevocational education, where teachers are already used to working with detailed qualifications frameworks, additional concretization of these qualification frameworks by the 4Cyourway framework helped teachers in their daily educational praxis as study 3 showed. The framework helped teachers develop rubrics at intermediate levels between two formal ones. It supported the feed forward to the students on how to reach the next level and also how to handle authentic learning experiences.

Thanks to the collective effort of teachers, educational developers, and researchers, it was possible to develop the 4Cyourway framework and instruments that can measure competence growth. The material is free accessible at http://www.4cyourway.nl. The research shows that the framework is a good basis for the development of educational tools, in particular for assessment, to determine the competence level and growth of students.

Measurement of competence is mostly a labor-intensive work. Assessment practical environment has to be developed and arranged when one wants to determine the student competence while doing the work. This might help in final examinations; however, to determine growth in a more frequent way or effectiveness of curricula and teaching it might be too time consuming and not always possible to realize. These studies show that Bartram's framework helped teachers to formulate levels of competence for different levels of education. This teacher's language showed to be a good basis for formulating rubrics that were clear enough for students to understand and respond in a valid way to sign which level of competence acquiring they experienced.

The instruments are valid, efficient, and easy to use even in large-scale studies or more practice-oriented research to support the teaching or curriculum development in schools.

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Chapter 27
Comparing Recognition of Prior Learning (RPL) across Countries

Sandra Bohlinger

27.1 Introduction

Recognition refers to the idea of (publicly) accepting, accrediting and somehow valuing learning results and/or previously received formal qualifications and certificates. In comparison, the term validation refers to the process of identifying, assessing and recognising knowledge, skills and competencies an individual has acquired in various learning contexts outside formal education and training systems. In 2001, the European Commission defined validation as the process of identifying, assessing and recognising a wider range of skills and competences (see Chap. 1 about the use of the concept competences in the EU policy-making context) that individuals develop through their lives and in different contexts, e.g. through education, work and leisure activities. Colardyn and Bjørnåvold (2004: 71) point out that validation is a crucial element to ensure the visibility and to indicate the appropriate value of the learning that took place anywhere and at any time in the life of the individual. Both recognition and validation are understood as 'a process that identifies, verifies, and recognizes relevant learning (knowledge and skills) acquired through work and other life experience that cannot be fully recognized by the traditional means of credential assessment, credit transfer, articulation, or accreditation' (Canadian Council on Learning 2009: 4).

Conceptually, recognising prior learning is not new. Allusions to the philosophies of Aristotle and Pestalozzi in their valuing of adults' experience preceded the work of John Dewey, who is regarded as the father of experiential learning, and Conrad (2014: 315 f.) points out that RPL is a 'respectably old practice, harking back to Socratic and Aristotelian endorsement of the value of experience in learning'.

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While the idea of valuing any kind of learning results has a long tradition, early *governmental* initiatives were implemented no earlier than in 1940s, when the United States developed its first state-based initiatives during World War II when veterans returning home were seeking opportunities to have their skills recognised for civil occupations (Heyns 2004; SAQA 2002). In Canada, the first initiatives started in the 1980s in Winnipeg/Manitoba to grant credit to learning acquired in noncollege settings in the area of nursing, dental assisting and early childhood education (Conrad 2008; Wihak 2006). In Norway, education for all has been a policy goal since the eighteenth century. Since the first version of the Vocational Training Act was passed in 1952, individuals have been allowed to take crafts examination provided they have sufficient practical work experiences (Ure 2007). With some minor changes, all three approaches are still in place and serve as role models for other countries.

Today, recognition and validation are gaining momentum in many countries inside and outside the EU, with varying drivers: national policy and legal environments, e.g. the Council of the European Union 2012. Recommendation on the validation of nonformal and informal learning requires all EU Member States to have RPL arrangements in place by 2018 including at least four elements (identification, documentation, assessment, certification) for the validation of nonformal and informal learning (Council of the EU 2012). In the same year, the UNESCO (2012) published the 'Guidelines for the Recognition, Validation and Accreditation of the Outcomes of Nonformal and Informal Learning proposing minimum standards for implementing RPL such as ensuring equity in access to learning opportunities, fostering the equal value of learning outcomes independent of how, where and in which settings they were acquired and ensuring the central role of individuals.

In many countries, national qualifications and credit frameworks are linked with RPL policies (e.g. Australia, France, South Africa), and/or there are strong workforce development agendas to which RPL is linked as in Scotland, and professional body activity, as is the case in Nursing in the UK, for example (see Harris et al. 2011 or Anderson and Harris 2006 for international perspectives on RPL research).

The heterogeneity and complexity of approaches and RPL-related notions is immense as are the multiple motives that underpin it (for a current overview see Singh and Duvekot 2013). However, at the core of the discussion and across countries we find similar criteria for implementing validation systems which are

- To promote lifelong learning
- To foster individual employability and meet labour market demands
- To strengthen countries' competitiveness
- To improve social inclusion and social justice (mainly by improving labour market inclusion)
- To better link labour markets and education and training systems

Also, we can identify a convergence of ideas and challenges that are common to numerous countries around the world and that are present in political, social and educational debates. They focus on the development of procedures, methods, guidelines and strategies to identify, document, assess, recognise and validate learning

acquired throughout the whole lifespan and in various contexts. RPL has become part of the lifelong learning paradigm, a new mode of valuing learning accomplished by individuals throughout their professional, social and personal lives and far beyond traditional institutional boundaries. As a consequence:

> where the boundaries among education, training, work and leisure are attenuated, the recognition of experimental learning, particularly those of adults, is an unavoidable challenge for the educational/training systems of the present day and age. (Pires 2005: 7)

The current restructuring of education and training systems is neither restricted to a terminological nor to an organisational change, though both aspects are key to the debate. Indeed, there are knowledge and learning types which function as reference models. Within Europe, one of the most often quoted ones is the terminology proposed by the European Commission (2001: 7) referring to the concepts of formal, nonformal and informal learning as developed by, e.g. Engeström (1984, 1991); Eraut (2000) and Scribner and Cole (1973):

- Formal learning consists of learning that occurs within an organised and structured context (formal education, in-company training), and that is designed as learning. It may lead to a formal recognition (diploma, certificate). Formal learning is intentional from the learner's perspective.
- Nonformal learning consists of learning embedded in planned activities that are not explicitly designated as learning, but which contain an important learning element. Nonformal learning is intentional from the learner's point of view.
- Informal learning is defined as learning resulting from daily life activities related to work, family or leisure. It is often referred to as experiential learning and can to a certain degree be understood as accidental learning. It is not structured in terms of learning objectives, learning time and/or learning support. Typically, it does not lead to certification. Informal learning may be intentional, but in most cases, it is non-intentional (or 'incidental'/random).

In nonpolitical contexts (particularly outside the EU), we often find a more simple differentiation between formal and informal learning pointing at the fact that the Commission's tripartition is more an artificial and politically intended one than a research-based one (Becket and Hager 2002; Bohlinger 2008a; Engeström 1991). Moreover, differentiating between formal and informal learning provides the opportunity to place emphasis on respective learning settings (time, place, contents, target groups, etc.) and types of learning (incidental, explicit, procedural, etc.) (Colley et al. 2003; Gagné 1973). In terms of terminology, each country and institution has its own preference ranging from recognition of prior learning (RPL), prior learning assessment and recognition (PLAR), accreditation of prior experimental learning (APEL), accreditation of prior learning (APL), recognition of nonformal and informal learning outcomes (RNFILO), validation of prior learning (VPL) and validation of nonformal and informal learning (VNFIL) to recognition of prior and experimental learning and learning outcomes (RPELLO). No matter what type of recognition approach is used and how it is labelled, the process of identifying and then valuing in some way the past learning of individuals and its results is widely practised

around the world, and it clearly indicates that there is no one-size-fits-all model for the recognition and validation of prior learning.

The same is true for the notion of 'learning outcomes'. With reference to the development of the European Qualifications Framework, the European Commission (European Parliament and the Council of the European Union 2008) declared knowledge, skills and competences' key components of the EQF and later complemented this definition by the umbrella term 'learning outcomes' that subsumes knowledge, skills and competences according to the Commission's definition. In comparison, academic discussions have mainly referred to models and theories on developing, evaluating and assessing knowledge, skills, abilities, competencies, capabilities or (work) experience rather than referring to the notion of learning outcomes – some of them reaching far beyond the political ideas of making learning visible (Bohlinger 2008a, 2008b; Colardyn 1996; Nussbaum 1995; de Terssac 1996; Sen 1999).

27.2 RPL Across Countries

Understanding the complexity and heterogeneity of approaches and terms can be reached by either describing the RPL situation from a national perspective (as provided by, e.g. the OECD country reports or the European Inventory on Validation) and thus subordinate comparative aspects *or* by approaching the topic thematically, i.e. by clustering and comparing, e.g. regulations, stakeholders, numbers, etc. across countries or by combining both approaches. Following the approaches to comparative education research developed by Theisen and Adams (1990) and Watson (1996), this section provides a brief insight into countries' RPL structures and regulations in terms of vocational and professional education. It includes ten country examples (Austria, Canada, France, Germany, Ireland, Italy, the Netherlands, Norway, Spain and Switzerland) chosen due to their diverse starting points, experience and traditions with RPL. While Canada, France and Norway have a long tradition in RPL, Italy has developed RPL only recently. In comparison, Ireland and Spain started an extensive process of restructuring existing regulations, and Austria and Germany both have specific regulations for particular professions but take much effort to link them with the overall education and training system. The findings are based on a 2-year project on RPL, credit point systems and mobility that was run between 2012 and 2014 (http://euvetsupport.eu) and included an investigation of

- National statistics, training regulations, policy documents and research papers
- Data from national/regional programme evaluations including interviews with national stakeholders
- Policy and research documents provided by international stakeholders such as the ILO, the OECD or the UNESCO

The focus is on vocational and professional education qualifications, respectively; however, higher education and general education (qualifications) are

mentioned in some cases, e.g. in terms of countries that have a national validation system covering all areas of education.

Given the complexity of this field and bearing in mind the growing number of evaluations on the current state of the art inside and outside the EU as provided in, e.g. the latest 'European Inventory on Validation of Non-Formal and Informal Learning' (http://www.cedefop.europa.eu/de/events-and-projects/projects/validation-non-formal-and-informal-learning/european-inventory) or by the OECD's reports on 'Recognition of Non-formal and Informal Learning' (http://www.oecd.org/education/skills-beyond-school/recognitionofnon-formalandinformallearning-home.htm), this contribution is intended to provide *additional* data on RPL focussing on procedures ('methods') and on assessment criteria against which competent bodies and agencies are judging applicants' prior learning outcomes.

Though data are not harmonised and thus hardly comparable, they provide an insight into the variety and complexity of the national situations. Data in this chapter are based on interviews with national stakeholders (which were run during the above-mentioned study), national statistics and country reports by the OECD and the European Commission, Cedefop and ICF International 2014 (except for Canada); additional sources are:

Austria: Brandstetter and Luomi-Messerer (2010); Klimmer et al. (2009); reference years, 2008 and 2009
Canada: Canadian Council on Learning (2009), Prism Economics and Analysis (2004); Statistics Canada (2014, reference year 2012) data for Canada refer to Red Seal Trades only, i.e. a particular type of trade for which all the provinces and territories have agreed on standards for entry into the occupation allowing for the portability of qualifications across Canada (49 trades)
France: Charraud (2010); Méhaut and Lecourt (2007)
Germany: BIBB (2013); BMBF (2014)
Ireland: Expert Group on Future Skills Needs (2011); Coughlan (2010)
Italy: Pertrulli and di Francesco (2010)
The Netherlands: Duvekot (2010); Kenniscentrum EVC (2014)
Norway: VOX (2012)
Spain: Lafont and Pariat (2012); Souto-Otero (2009)
Switzerland: Salini et al. (2012); FSEA and SVEB (2014)

27.2.1 Applications and Costs to Individuals

The recently published *Handbook of the Recognition of Prior Learning* Van Kleef (2014: 356) states that 'studies on what happens to PLAR learners after assessment are conspicuous by their absence in the literature. However, if one digs deep enough, research does appear, and a picture of the outcomes and impacts of PLAR on adults in education begins to emerge'.

Table 27.1 Number of applications

Austria	No overall data available; external exams (VET): approx. 15 % of all exams (6982 in 2012); admission to university programmes without the *matura* (*Reifeprüfung*) < 1 %
Canada	In 2014, 27.4 % (15,429) of all Red Seal Certificates were awarded to candidates who took the exam without attending an apprenticeship programme
France	In 2012, the number of candidates considered eligible to RPL is 63,543; the number of candidates applying for RPL is 48,709; diplomas delivered by RPL are 28,677
Germany	The number of candidates who applied for RPL as access to final vocational qualification exams is 34,674 in 2011 (7 % of all exams; success rate 78 %); the number of qualified workers among first-year HE students (RPL for HE access) is 1.9 %; the number of applications for recognition of foreign formal qualifications at all levels in 2013 is 10,989
Ireland	No overall data available; RPL-based certificates issued by FÁS (Irish National Training and Employment Authority) are 16,000 in 2006 and 82,000 in 2008
Italy	No data available
Netherlands	The number of certificates awarded through RPL (Ervaringscertificaten) in 2011 is 17,700 including applications for MBO qualifications (VET schools, branch or sector qualifications), applications for HBO qualifications (universities of applied science), applications for sector-specific qualifications; approx. 80–90 % of all certificates were issues at MBO level
Norway	In 2013, 7 % of all students in postsecondary vocational colleges were admitted by RPL; in 2011, 12.5 % (2457) of adult learners in upper-secondary education and training had their prior learning assessed; 38 % of students in VET programmes had their prior learning assessed
Spain	No current reliable data available; according to Royal Decree 1224/2009, funding is available for 60,000 individuals to be validated
Switzerland	Upper-secondary 'Federal' Diplomas of VET in 2013 are 768 (approx. 1 % of all diplomas); higher VET (PET, Professional Education and Training), 191; PET certificates and diplomas for trainers in adult education of a total of approx. 3327 certificates and diplomas; 61 PET Diplomas for community interpreters; HE access for those without baccalaureate: approx. 1 %

Though Van Kleef actually finds and presents numerous data on the whereabouts of RPL candidates, it seems much more difficult to find reliable, regularly updated and comparable data on the number of applications. Compared to formal education and training, international statistics do not (yet) exist, and data mostly refer to national programme evaluations or academic studies. Comparing data presented by, e.g. the OECD or the European Inventory during the past decade, we can clearly see that countries are developing initiatives for data collection and improvement of data quality.

Against this background, the following overview represents Van Kleef's picture of the 'absence in the literature' rather than it can provide a complete picture of the scenery (Table 27.1).

The absence of data and discussion also refers to funding. Referring to countries' experience with RPL the European Commission, Cedefop and ICF International

Table 27.2 Costs to individuals

Austria	External exams (general education): EUR 15; admission to external exams (VET): EUR 125–150; BRP (*Berufsreifeprüfung*, a particular type of VET diploma that provides general access to HE. This exam can be taken without prior attendance from upper-secondary schools.): exam fee: approx. EUR 450; preparatory classes for BRP: EUR 2600–2800
Canada	Approx. EUR 72–236, depending on trade, examination and type of application
France	Depending on the type and level of qualification between EUR 0 and 1000. For VET qualifications, fees are approx. EUR 800
Germany	Approx. EUR 100–600, depending on Land, trade, time and effort
Ireland	Depending on institutions, discipline, NQF level and purpose; applications for the consideration of certified learning are usually cheaper than assessment of experiential learning; approx. EUR 600–2000 (in general); levels 4–7 of the Irish NQF: approx. EUR 1000–1250; levels 4–5 of the Irish NQF, VET only, approx. EUR 800–1350
Italy	No reliable data available; in Tuscany: approx. EUR 500–1200
Netherlands	HE: approx. EUR 1000–1250 (including costs of assessment and recognition of the results); on average, procedures carried out by MBO institutions (VET at upper-secondary level) are cheaper, since part of the costs is compensated for by the enrolment of the participant in regular training programmes; overall costs for RPL at VET levels: EUR 800–1300 (shared by employer and employee). If RPL is not funded by the government or the social partners, applicants can fiscally deduct all costs for RPL exceeding EUR 500
Norway	Free of charge for unemployed and disabled and those born before 1978; otherwise approx. EUR 100–1800
Spain	According to Royal Decree 1224/2009 approx. EUR 10–30 per candidate
Switzerland	Average costs per person for validation procedures EUR 5142

(2014: 43) summarise: 'In this respect it is interesting to note little discussion in the country reports about funding mechanisms to make validation sustainable'.

Since data are hardly available, particularly with respect to the overall funding mechanisms including public funding and costs to companies, the following table refers to individual costs (in terms of application fees) only (Table 27.2).

Compared to previous data on costs to individuals (e.g. Bohlinger 2013; European Inventory 2010 Update), costs to individuals have increased in almost all countries, though there is a wide range of fees and exceptions are in place in some cases. However, given the quality of the data, they provide a snapshot and a starting point for future research rather than they reflect an overall picture of the situation.

27.2.2 Assessment Criteria and Recognition Procedures

In all countries, assessment criteria refer to formal professional, vocational or academic qualifications. They are based on particular types of national, professional or sectoral standards; some of them developed by (national) competent bodies, some

Table 27.3 Assessment criteria

Austria	Candidates are tested against legally binding framework at national level (national standards)
Canada	Red Seal Endorsement standards
France	Candidates are tested against professional standards; the standard procedure of the RPL process (bilan de compétences) varies between 20 and 24 h (documentation + preparation, 12 h; assessment, 4 h; self-study, 8 h)
Germany	National professional standards
Ireland	Professional or educational or scientific standards
Italy	Sectoral/educational standards (envisaged)
Netherlands	National regulations and standards for VET and HE
Norway	National professional standards
Spain	Recognised qualifications listed in the National Catalogue of Professional Qualifications and described in terms of key skills and technical competencies
Switzerland	National professional standards

of them developed by educational institutions. In most cases, such standards are legally binding which again is particularly the case with those countries where the envisaged qualification is linked with qualifications frameworks (e.g. France, Ireland). In some countries, a national validation strategy is either in place (France, Spain, Norway and Switzerland) or under development (Austria, Germany) and provides (or is planned to provide) a legally outlined fundament for validation activities.

In some countries (Austria, Canada, Germany, Switzerland), the private sector plays a crucial role in developing professional standards which in turn are the basis for recognition and validation (Table 27.3).

However, such 'assessment' criteria do not refer to the RPL procedure. While national and or sectoral or institution-specific regulations on RPL referring to eligibility, awarding bodies, public funding, etc. are in place in all countries, procedural structures and methods of assessment vary between countries, regions, institutions and professions.

In general, RPL processes are run similarly across countries and cover several steps. However, the number of steps varies between institutions, countries and references. Whereas the Council of the EU (2012) proposes four steps (identification, documentation, assessment and certification), Werquin (2014: 101) refers to seven key technical steps:

1. Information, advice and guidance to the potential applicant and initial documentation
2. Eligibility and decision to allow the individual to apply
3. Further documentation
4. Assessment
5. Decision
6. Certification and awarding of a qualification
7. (Societal) recognition

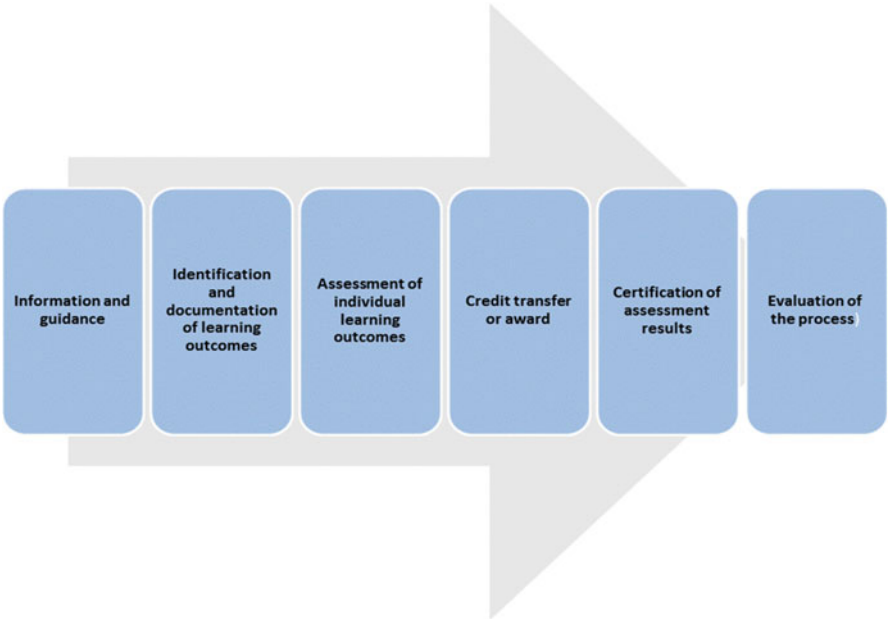

Fig. 27.1 Six steps of a RPL process

In our research, we found that institutions refer at least to four of the following five steps (Fig. 27.1).

Before individuals take the decision to seek validation, they need *information and guidance* to know what the added value (benefits) will be, what is to be expected, what preconditions and standards have to be met and what types of documents have to be provided and developed by themselves. During this first stage, individuals receive written or oral information on the overall RPL procedure (e.g. timelines for validation, costs, procedures, types of evidence of learning outcomes, etc.). The first step may be provided online, face-to-face, by phone, etc. In all countries where RPL procedures are in place, this step is free of charge and provided either before the overall process, during a single stage (mostly the first stage) or during the overall process. In some countries, it is provided by either the competent bodies that run the assessment procedure (e.g. Austria, Canada, Germany) or by independent institutions and information providers to avoid a mix-up of the various stages of the overall RPL process and conflicts of interest (e.g. France, Ireland).

The aim of *identifying and documenting learning outcomes* is to make individuals become *aware* of their learning outcomes that are relevant for the RPL process, and thus to make the learning outcomes visible and understandable. From a content point of view, this step is mostly linked with the formal qualification the procedure is aiming at, i.e. the dialogue and the portfolio are linked with particular knowledge, skills, and competences that are part of the envisaged qualification.

Assessment of individual learning outcomes is a general term that refers to all methods used to judge individual performance. It may either concern the student or the trainer (teacher, instructor), but also the training methods (evaluation). The related terms 'test' and 'exam' are mostly used to describe an assessment conducted in a formal learning setting and designed to ensure basic test criteria (high objectivity, reliability, validity, fairness, transparency, etc.).

All assessment is done against predefined criteria. Such criteria include national/sectoral standards (that are either the same as or equivalent to the standards for qualifications obtained through formal learning processes; see above), expectations, measurement of learning outcomes and the scope of assessment criteria. In general, assessment can focus on individual learners, groups of learners (class, workshop, training programme, etc.), an institution or an education and training system as a whole. In RPL contexts, assessment focuses on an individual and his/her learning outcomes.

Assessment is mostly conducted by competent bodies or national/regional authorities who have the legal right and the expertise to assess the learning and to award credit and qualifications. Assessors' qualifications and competencies are crucial for RPL: they decide on what is worth being documented, assessed and accredited. However, few countries have clear regulations on what makes a professional a professional in the field of RPL, and our findings are coherent with those stated in the latest version of the European Inventory stating little progress during the past years: 'The development of professional competences of staff is an area that requires strong development in most countries […] In 26 countries development was reported not to be a right or it was reported that there was no provision for it. In this area there has been little progress since 2010' (European Commission, Cedefop and ICF International 2014: 25; for an international discussion see Travers and Harris 2014). The following table provides an overview of qualifications required from assessors (Table 27.4).

Credit transfer or award and *certification of assessment results* are closely linked, since certification may be provided by those experts involved in the assessment itself. However, when credit is granted for prior (formal) learning as part of a validation process, this has not necessarily been done by the same experts. Particularly in terms of granting time credit proved by formal work contracts, letters of recommendation, etc., involvement of assessors is not necessarily necessary.

Certification can be obtained either in terms of a full qualification or in terms of a part qualification. If a full qualification is not awarded due to a lack of, e.g. work experience or due to a lack of conceptual knowledge, a candidate may be awarded a part qualification and receive complementary education and training (in terms of programmes, further experience or additional learning units to receive the specific full qualification).

Evaluation is one of the blind spots of RPL, and hardly any (national) competent body runs evaluations (e.g. on the quality of procedure or the whereabouts of candidates) on a regular basis. However, regularly run evaluation would improve quality and transparency of RPL procedures. Some countries like Canada, France, Germany and Norway have established databases and compile statistics on RPL which are a first step to run evaluations.

Table 27.4 Assessors' qualifications

Austria	Members of exam committees are set up by apprenticeship offices; members are 'experienced professionals' or teachers
Canada	Professionals; no national regulations in terms of further requirements
France	No explicit requirements set in the national legislation; jury members must have relevant experience as professionals or teachers
Germany	Professionals; no mandatory qualification requirements for validation practitioners
Ireland	In HE, academic staff; in VET, qualified individuals
Italy	Professionals; no mandatory qualification requirements for RPL
Netherlands	Individuals have to prove their professional standards; however, there are no standards or certificates. A proposal for a standard was developed in 2000 but is not yet in place (2014)
Norway	Counsellors, assessors and validation process administrators; participation in continuing training is mandatory
Spain	Assessors and guidance practitioners must attend specific additional training *and* must be experienced professionals, i.e. have at least 4 years' work experience as secondary and/or VET teachers *or* as trainers *or* as professional experts specialised in the respective competence field
Switzerland	Two types of qualifications requirements for RPL practitioners in upper-secondary VET set in the 'Control List for the Skills Audit Centres' (2010): *validation guidance practitioners* are recommended to be trained for validation practices and are not to take part in the assessment and certification. *Assessors* need to be professionals in their field of expertise but need no additional qualifications

27.2.3 Assessment Methods

In terms of assessment, the most common 'method' is assessment of documents (certificates and forms) by competent bodies. However, candidates often feel that assessment of documents is an intransparent procedure, particularly if RPL is based on the assessment of formal documents only. Apart from document assessment, all countries apply numerous assessment methods for RPL, mostly written and/or oral examinations, documentations, portfolios, simulations, observations and evidence from real situations at work or in other contexts.

None of the countries has strict regulations on how and when to apply which method. In all ten countries, the results are assessed against 'standards' which may be national ones, sector-specific ones or standards developed by the assessing institutions. Assessment is run by experts, i.e. professionals who in some cases (e.g. Norway, France, Spain) have to acquire additional skills and qualifications for RPL. The envisaged outcome of assessment is to award a formal qualification (diploma/certificate) and to improve labour market and/or educational access. Also, some countries like Germany and Norway provide additional training plans and/or the validation of competence units without awarding the full formal qualification.

Basically, methods used for identifying, assessing and validating prior learning are the same ones used for assessing formal learning, and they are similar across

countries and purposes. The only exception is higher education where, in most countries, no common process is in place. The most common methods are:

- *Interviews*: In all countries, they are perceived particularly useful in areas where judgement and reduction of complexity is necessary and/or when candidates have to prove strong oral communication skills. In an interview, candidates confirm their ability to demonstrate their knowledge of a subject and – in case of group interviews or debates with peer candidates – their capacity to sustain a considered argument and to demonstrate communication and social skills.
- *Workplace observation and simulation of working tasks*: Though highly reliable and valid, workplace observations and simulations of working tasks are less common than interviews or written tests. Observations and simulations may be either conducted in a way that a) candidates demonstrate their knowledge, skills and competencies by executing a given task that is observed and assessed by assessors or that b) candidates observe other persons executing a given task and afterwards will be asked by the assessors to explain what they have observed.
- Whereas (a) is more convenient and less costly, (b) seems particularly helpful for candidates aiming at qualifications in very complex situations where judgement and observations skills are needed.
- *Oral/written (standards-based) tests*: Due to low costs, high levels of objectivity, validity, reliability and fairness, oral and written tests are the most widely accepted and applicable form of RPL methods. Whereas written tests require a minimum of writing skills but allow for reflecting on an answer before giving (writing) it, oral tests are used to demonstrate in-depth understanding of complex issues and the ability to explain them in simple terms. In some countries like Canada, multiple-choice tests are common in RPL, since they are considered more objective than other methods. However, multiple-choice tests are often criticised as too narrow to represent the complexity of learning outcomes.
- Another written test method are essays which are used to check the quality and standard of a required writing skill level, the ability to develop a coherent argument and to confirm extent, understanding and transferability of knowledge and critical evaluation of ideas.
- *Portfolios*: They are an organised collection of (written) materials (either on paper and/or digital) that presents and verifies learning outcomes acquired through experience. In many countries and sectors, it is used either as an integral part of the overall validation process and thus as part of the assessment or as an integral part of the overall validation process that has to be compiled by candidates but is not part of the assessment itself. Portfolios provide the opportunity to actively involve candidates in the RPL process and usually offer a mix of approaches strengthening the overall validity and reliability of the method. An individual portfolio might include letters of reference, testimonials, résumés, photographs of work samples, presentations, etc.
- Whereas portfolios are less common in formal education and training, they are a common method in RPL, since they can promote learners' awareness of the RPL process, focus learners' attention on quality assurance and increase candidates'

self-responsible integration in the RPL process. However, to guarantee that quality standards in developing portfolios are met and consistency is provided, we recommend that candidates receive support and feedback when preparing their portfolios.

– *Product-based methods*: Products can be, e.g. portfolios, written reports, videos, photos, work samples or exhibitions of work. Product-based methods can be used to have candidates demonstrate their knowledge, skills and competencies in a complex way that is closely linked with real workplace situations. Thus, the method needs to specify whether the product only will be assessed, or whether it will also include the production process. If the RPL procedure is product based only, then candidates need to be instructed on what to include in the product. The conditions for producing the product should be clearly specified in the beforehand and provided to candidates since it will directly influence the type of response to be produced by them. If the method also incorporates assessing the process of building the product, then the observations of the process would need to be also judged and recorded and thus needs a clear instruction how this judgement and recording should be provided by candidates. Product-based are more common in non-European countries than in European countries (e.g. Australia, New Zealand).

Additionally, credentials, i.e. evidence and assessment of prior professional achievements in terms of documents (CV, work contracts, letters of reference, etc.) and of written statements (press book, ICT production, etc.), are mandatory in most countries. Also, an interview with the assessing jury is not compulsory but is used in some countries (e.g. in France).

Similar to the findings provided by Souto-Otero (2010), most countries consider a combination of the above-described methods, an optimal method of assessment, allowing the verification of learning outcomes in various ways. Challenges that stem from the methods are particularly reported with respect to the use of portfolios, i.e. the amount of time that is necessary to prepare and to gather evidence.

Other methods like workplace observation or work samples are reported to provide high-quality results in terms of reliability, objectivity and validity. However, they need intensive resources in terms of time, staff and costs.

27.3 Conclusions

There are numerous studies on recognising and validating learning outcomes and prior learning (e.g. Bartram 2005; Bohlinger and Münchhausen 2011; Bowman et al. 2003; European Commission, Cedefop and ICF International 2014; Harris et al. 2014). While the majority of research studies and policy documents focuses on its role as a means of facilitating participation in, or returning to, formal education and training and/or the labour market at national/regional levels, there are few studies providing reliable and comparative data on the actual impact of RPL (Smith and Clayton 2011; Van Kleef 2014) However, there is an emerging linkage between

educational research on RPL on the one side and politically driven and/or demand-driven initiatives on the other side. For example, the work of the Prior learning International Research Centre (PLIRC) seems significant in this regard. Hosted by Thompson Rivers University in Canada, PLIRC is an international network of scholars aiming to stimulate innovative RPL research and to disseminate research findings to practitioners, policymakers and the research community via publications and a database offering open access to most international research articles and publications.

Whereas we can easily identify a number of policy documents praising the benefits of RPL, we find few (research-based) studies on why countries are not in favour of RPL. Surely, our study has some limitations that should be considered before generalising the results. However, earlier findings stated by Dyson and Keating (2005) or Singh (2005) were confirmed by our findings (see chapter 'RPL across countries') and refer to four types of obstacles for RPL, i.e. institutional, organisational, cultural and individual barriers:

Institutional obstacles include qualifications structures and rules, awarding and assessment criteria and financing mechanisms. Institutional obstacles very much depend on the degree of outcome orientation of an education and training programme. Moreover, awarding and assessment rules tend to be institutionally specific. They are mostly built around course participation and completion. Thus, RPL is often not readily accessible to nontraditional learners, and/or the financing of the RPL process is not separated from the course financing.

Organisational obstacles can be found with regard to the practices of competent bodies, education and training institutions and providers that prevent individuals from RPL and from fully benefiting from recognition schemes that are in place. Moreover, organisational obstacles are very much linked with financing mechanisms: RPL is time consuming and cost-intensive, since it is usually not part of providers' standard assessment procedures which in general are coupled with formal education and training programmes. Decoupling such programmes and its inherent assessment procedures demand for either more differentiated financing mechanisms or new modes of cost accounting or a different understanding of learning and its outcomes. Next to the issue of financing mechanisms is the one of who is assessing, recognising and validating prior learning. Most countries have established (national) competent bodies to offer and/or support recognition and validation procedures and thus are awarding bodies (e.g. Germany, Ireland, the Netherlands). However, in some countries (regions, sectors), these bodies have no awarding rights, as governments view this as a conflict of interests.

Cultural obstacles are based on a lack of trust in RPL or in the value of prior learning per se. Such a lack of trust may result in overly rigorous or overly lax RPL procedures and/or a lack of supporting infrastructures (lack of time, adequate procedures, staff). Thus, cultural obstacles are very much linked with the public image and acceptance of nontraditional types of learning and its certification and accreditation.

Individual obstacles are a bundle of complex and contradictory aspects. One of these aspects is how to attract learners who are not familiar with formal procedures in learning contexts: While most countries made high investments in encouraging

individuals' participation in continuing (vocational) education and training, little attention has been paid to encouraging learners' participation in RPL (with few exceptions like in France, the Netherlands or Norway). Moreover, individuals with high levels of education are more likely to participate and invest in formal education and training and RPL than low-qualified people. Thus, there is a high risk of leaving behind nontraditional learner groups. This is even more likely as regards to gaining information about recognition and validation systems: Gaining such information is generally a difficult procedure, and it is even more difficult for individuals with weak education biographies.

Another issue is the scope of RPL: In some countries (e.g. Norway, South Africa, Australia, Denmark), the presence of national validation systems (which partly include national qualifications frameworks) seems to foster participation in RPL, since it is based on national standards and linked with competent bodies awarding formal qualifications. This again is closely linked with the issue of qualifications frameworks. In countries in which they exist, national qualifications frameworks (NQFs) have a central role in validation contexts due to the standards and qualifications (even for assessors), recognition and quality assurance procedures they usually provide. In some countries such as France or Ireland (and, e.g. Australia, South Africa and New Zealand), RPL for VET does not differentiate between learning outcomes achieved inside or outside formal learning programmes. However, the actual impact of NQFs on improving validation systems and education and training systems in general is limited, and little is known about their long-term effects (Allais et al. 2009; Bohlinger 2008b). Moreover, it is unclear whether they are an enabling or an inhibiting factor in promoting RPL: While in some countries, implementing validation procedures follows a bottom-up approach driven by companies, unions and learning providers, other countries develop top-down approaches including NQFs and validation systems driven by supranational or international developments. Thus, NQFs can be a pushing factor in the practice of RPL, if they establish common benchmarks and standards which allow for the formal equivalence of qualifications recognised through recognition and validation. What they cannot be expected to do is act as generators and promoters of the acceptance of RPL. This needs a long-term strategy close to the workplace and provider levels as well as close to learners, teachers and trainers.

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Chapter 28
Competence Assessment as Learner Support in Education

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28.1 Introduction

The assessment of professional competence has developed progressively in the last decades following the changes occurring in education. Education has shifted from an input model of education to an outcome-based model of education (Chappell et al. 2000). Instead of requiring certain hours in a curriculum on certain disciplines (the input model), modern education programmes are based on a defined set of outcomes or competencies (the output model). All courses and the assessment are then aligned to these outcomes. A second major shift is that many of these outcomes or competencies move beyond the knowledge domain, into more authentic professional skills or general competencies relevant for success in the labour market (Semeijn et al. 2006). Being able to work in a team, being able to communicate, being able to write academically and being able to behave professionally are examples of these general competencies. They are less domain specific, hence their general or generic nature. Both success and failure in the labour market are associated with these kinds of skills (Heijke and Meng 2006). As a result modern curricula pay more attention to the development of these skills. Finally, a third major change is a didactical one, where education is moving from atomistic to holistic learning, from teacher-centred learning to student-centred learning, from an exclusive focus on

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lecturing to more active learning methods and from highly teacher-led structured learning to self-directed learning (Merrienboer and Kirschner 2007). The assessment of professional competence has followed these educational developments. Therefore, assessment has moved beyond the knowledge domain, towards more complex assessment of skills in authentic contexts. In the literature, a difference is made to testing and assessment (Segers et al. 2003). Testing would refer to more classic approach of standardized testing of mainly cognitive functions, whereas assessment includes more modern forms and more authentic forms of assessment. We prefer the term assessment as an overarching term for all forms of assessment in which abilities of learners are assessed, whether conventional or modern and innovative and whether yielding quantitative or qualitative information. In this chapter we will use three different perspectives on assessment to illustrate the implications of educational developments for assessment practice: assessment *of* learning, assessment *for* learning and assessment *as* learning.

In an assessment *of* learning perspective, the focus is on optimizing appropriate decisions on our learners (Segers et al. 2003). This is associated in the literature with the term summative assessment. Have our learners achieved certain educational standards? Can we account for taking the right decisions over them? The emphasis is on the credibility of the decision-making function of assessment. In the assessment *of* learning perspective, an overview will be given on various classes of assessment methods, each assessing competence with different levels of authenticity. Subsequently, lessons learned are summarized from the research that has emerged from these classes of assessment methods. This will cover issues of reliability, validity, objectivity and impact on learning. The overview will lead to a set of general recommendations for assessment. One very central recommendation will be that any individual assessment method will always be a compromise on its qualities and will have serious limitations.

In an assessment *for* learning perspective, the focus of assessment is on its effect on learning (Black and Wiliam 2009). Does the assessment provide meaningful feedback to learning? How does the assessment support the on-going learning process? How may assessment promote deeper learning strategies or certain developmental outcomes? We will provide an overview of the literature on assessment *for* learning, also named formative assessment. More particularly, an overview will be given of the most current methods used for formative assessment in the classroom and the requirements for being effective for learning. The overview is informative for teachers wishing to use assessment to guide learning.

Finally in an assessment *as* learning perspective, both the decision function and the learning function are united in one single synthetic approach to assessment (Clark 2010). Assessments are seen as an integral approach by looking at the design of full assessment programmes. Limitations of individual assessment methods can be overcome by looking at assessment from a programmatic approach. Comparable to a curriculum, assessment programmes are planned, implemented, governed, evaluated and adapted. We will discuss an approach to programmatic assessment in which the perspectives of assessment of learning and assessment for learning will

be intertwined. Finally, an illustration is given of an existing assessment practice that was designed programmatically.

In the following, each assessment perspective is outlined. We will refrain from providing methodological, theoretical or psychometric overviews in assessment. Methodologically oriented theories of assessment are well developed and abundantly available (Zwick 2006; Kane 2001). Our intent is to provide assessment insights on each perspective that may have direct relevance to educational practice.

28.2 Perspective 1: Assessment of Learning

28.2.1 Classifying Methods of Assessment

In any method of assessment, we can make a distinction in the stimulus format and the response format. The stimulus format is the kind of task one gives to the person being assessed. A stimulus might be asking for a fact or it might be a rich scenario. The response format is the way one captures the response. This could be a small menu of options, a write-in response, a long essay, an oral form, etc. The number of assessment methods resulting from combinations of stimulus and response formats is really infinite and impossible to reproduce and explain. Instead we will use a very simple model of competence to classify methods of assessment. Miller proposed a pyramid of competence with four different layers (Miller 1990). Figure 28.1 gives an overview of the layers of the pyramid and the way these layers can be assessed. At the bottom of the pyramid is "knows" representing the assessment of factual knowledge. This is mostly done through written or computer-based tests testing for facts. Methods may range from multiple-choice tests, short answer tests or oral

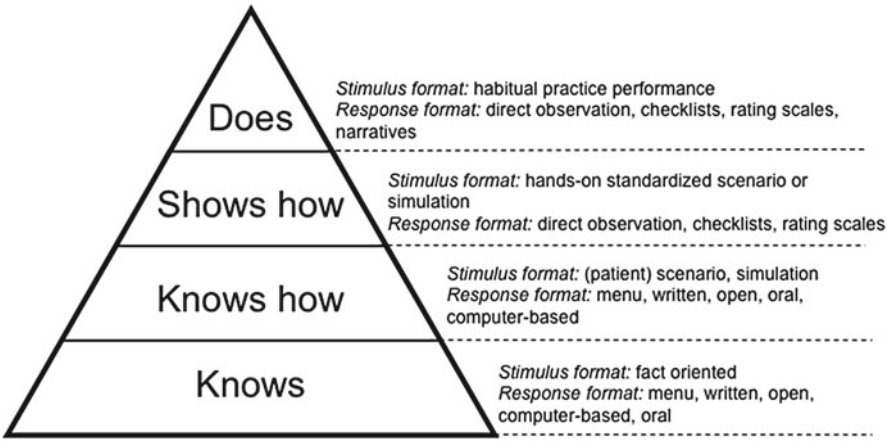

Fig. 28.1 Miller's pyramid of competence with each layer classifying methods of assessment

examination testing for facts. Once a learner is able to use the knowledge and apply it to cases or is able to solve or reason through problems, this is then called 'knowing how'. Methods of assessment may be very similar to the first level in terms of the response format, but now they typically rely on richer stimulus formats such as cases, quizzes, problems or scenarios. Higher-order cognitive skills are assessed, in which reasoning and application of knowledge is required. Open-book exams fall into this category too (Koutselini Ioannidou 1997). Other examples are essays, oral assessments where learners present cases or longer reports on project work or research projects (Segers and Dochy 2001).

Where the first two levels assess cognitive skills, the top two layers assess behavioural performance. At the 'shows how' level, behaviour is assessed through a simulation of professional tasks that is being judged on checklists, rating scales or in narrative forms. A widely known example is the assessment centre. Candidates are presented with tasks in a simulated work setting and have to deal with these assignments professionally. Assessment centres are used in many different contexts such as in career decisions in the police force (Feltham 1988), selection of naval officers (Jones et al. 1991) and in business (Sagie and Magnezy 1997). In health sciences such as medicine, dentistry and nursing, they use what is called Objective Structured Clinical Examinations (OSCEs) (Petrusa 2002). An OSCE consists of several stations with each station presenting a different simulation. Candidates rotate through these stations and a different examiner in each station scores the performance using a checklist or a rating scale. In a number of countries in the world, these performance tests are part of national licencing examinations for medical students and are used on a very wide scale in virtually all schools training health professionals. The next level of competence, the 'does' level is when actual behavioural performance is being assessed in real-life work settings. Work-based assessment can be assessed indirectly, for example, by judging artefacts or products of the work, or directly by judging observed performance. For example, an experienced teacher may observe a student teacher while teaching in a classroom. Other typical instruments are ratings by supervisors or ratings by multiple persons such as in the multisource feedback (MSF) or 360° feedback. In the latter, a set of ratings is used from a range of relevant co-workers or clients or other relevant persons, providing quantitative (rating scales) and qualitative information (narrative information) on the person being assessed (Brett and Atwater 2001; Wood et al. 2006). This information is reported back to the learner in an aggregated form and often complemented with a self-assessment. Another instrument that is rapidly gaining interest is the portfolio. In a portfolio the burden of evidence is reversed from teacher to learner. Based on preset criteria, usually derived from output definitions or competency definitions, the learner has to demonstrate fulfilling these criteria through presenting evidence (artefacts, other assessment information, recorded activities) and by reflecting on the evidence. Portfolios have gained tremendous popularity in virtually all fields of education and several reviews on their value have been written (Butler 2007; Van Tartwijk and Driessen 2009). What is important to note is that the first three layers of Miller's pyramid are about standardized testing technology, whereas the fourth layer is on non-standardized assessment technology. In standardized assessment, all

assessment conditions are as much standardized as possible for all test takers, even the more authentic assessments in the third layer. When assessing in real practice, standardization is impossible and assessment is based on more subjective, often more holistic judgements in non-standardized conditions.

28.2.2 Principles of Assessment

Each of the layers of Fig. 28.1, in fact each of the instruments in each layer, could be a full chapter, so it is impossible to be comprehensive here. Instead we are taking a different meta-analytical approach and sketch the consistencies found in the research that lead to principles of assessment of a more generic nature applying to more than one or all assessment methods. We partly rely on the work of Van der Vleuten et al. who sketched a number of these consistencies (Van der Vleuten et al. 2010). Table 28.1 summarizes a set of slightly modified principles for standardized and non-standardized assessment, respectively, and we added practical consequences for its implications to educational practice. We will discuss Table 28.1 systematically.

One very consistent finding is that competence is *specific and not generic*. Whatever is being measured and whatever method it is assessed with, competence and resulting performance are contextually bound. If we sample one element of performance (in an item, or question, situation, station, scenario), that performance is not very predictive for performance on another element. Therefore, many elements need to be sampled in order to be able to make an inference on someone's ability independent of the sample used in the assessment. This is often referred to as the reliability of an assessment or the reproducibility of the findings. The phenomenon has been termed differently in different domains as content specificity or task variability (Swanson et al. 1995; Shavelson et al. 1993). Two elements in any assessment 'disagree' considerably about the performance of a learner, and therefore we need many elements in any assessment. How many elements are needed varies from method to method and from situation to situation. By looking at overall testing time from various methods across Miller's pyramid at least 3 to 4 h of testing time is required to produce stable findings (Van der Vleuten and Schuwirth 2005). Therefore, shorter tests will deliver quite a few false positive and negative decisions. The practical implication is that we should sample contexts or test elements as much as possible within one particular assessment. For example, in an assessment centre, one cannot rely on sampling a few situations. In order to make a confident decision on the competence of an individual, we need many situations, often requiring more than 3 or 4 h of testing time in total. We should therefore be careful with one moment of assessment. We should preferably combine information from different assessments or from assessments over time. One measure is really no measure, at least when pass/fail decisions need to be taken that have serious consequences for the learner.

At the same time, it has been found that content specificity equally affects all method of assessment, so one instrument is not really inherently better than another

Table 28.1 Consistencies in assessment research and their practical implications

Standardized assessment Assessing 'knows', 'knows how', 'shows how'	Practical implications
Competence is context specific, not generic	Broadly sample performance across content within each assessment
	Combine information across assessment or across time
	Avoid high-stake decision on a single assessment
Objectivity is not the same as reliability	Use holistic professional judgement when it is needed
	Use many subjective judgements in combination
What is being measured is more determined by the stimulus format than by the response format	Any method may assess higher-order skills
	Produce stimulus formats that are as authentic as possible (scenarios, cases, etc.)
Validity can be 'built-in'	Organize quality assurance cycles in item and test development
	Use peer review
	Use psychometric information
	Use student input
Unstandardized assessment Assessing 'does'	Practical implications
Bias is an inherent characteristic of professional judgement	Use sampling to reduce systematic errors
	Use procedural measures to reduce unsystematic errors that build to the credibility of the judgement
Validity lies in the users of the instruments, more than in the instruments	Prepare and train assessors and learners for their role in the assessment
	Create working conditions that embed assessment possibilities
Qualitative, narrative information carries a lot of weight	Use words for assessing complex skills
	Be aware of unwanted side effects of quantified information
Feedback use needs educational scaffolding	Create feedback dialogues
	Create feedback follow-up
	Create meaningful relations between teacher and learners
Overall	Practical implications
No single method is perfect	Vary in use of assessment methods
	Combine information from multiple assessment sources

instrument in terms of reliability (Van der Vleuten et al. 1991). Methods of assessment that are traditionally considered to be more objective do just as well (or just as poor) as more subjective methods, all depending on the sampling. Objective assessments (e.g. an MCQ exam) can be unreliable when it samples only a few items, while more subjective formats (e.g. an oral examination) can be reliable when it uses sufficient samples of content and assessors. Usually in standardized assessment, two assessment contexts 'disagree' more on the ability of a learner than two assessors. Therefore, when multiple contexts are being used for wider sampling and different assessors are used for the different contexts, reliable scores and decisions can be achieved. Yet in other words, *reliability is not the same as objectivity* and should not be confused. It implies that whenever professional judgement is inherently required, we should use it and not avoid it. Professional judgement is needed to assess complex skills (e.g. poetry writing, writing a scientific text) or complex performances (e.g. dealing with a client, communication in a team, a musical performance, a surgical intervention, etc.). Professional judgement may come from an expert but also from peers or co-workers. Sometimes the professional judgement comes from the self.

Sometimes teachers make claims on the virtues of certain methods as if methods of assessment have a fixed inherent validity. However, *what is being measured is more determined by the stimulus format than by the response format* (Schuwirth and van der Vleuten 2004). The task in the assessment that is given to the learner defines much more what is being measured than the way we capture the response. So, for example, open-ended question may assess factual recall (Miller level 1) and a multiple-choice item may assess problem solving (Miller level 2), all depending on what is being asked in the question itself. Whether the response is a short menu (like in the MCQ) or an open answer has relatively little impact on what is being assessed. The practical implication is that we should be more mindful about the stimulus format rather than the response format. In educational practice, often the reverse is the case and choices are often based on naïve assumptions about inherent qualities of an assessment method. Authentic tasks are typically used for assessing higher-order skills. The way these authentic tasks are written and presented to the learner is really important for being able to assess these higher-order skills. They can be operationalized in virtually every response format.

Many in-house assessments in educational practice suffer from quality (Jozefowicz et al. 2002). Quality assurance around item and test development has a dramatic effect on the quality of the assessment (Verhoeven et al. 1999). Therefore, much of the *validity can be built into the assessment*. Quality assurance can be done before and after a test administration. Measures before test administration may include peer reviewing of test material; piloting test material; developing scoring standards, checklists or scoring rubrics; training of assessors; and choosing an appropriate standard setting method (Cizek 2001). After test administration, item and test statistics may be used for deciding to drop poor performing items. Student comments may be quite useful for that purpose as well. When psychometric expertise is available, tests may be corrected for difficulty variations and scores of items and students expressed on a similar standardized scale. All these measures have a

tremendous effect on the quality of the assessment. Naturally, they are also resource intensive. However, assessments without any quality control, as it is often the case in educational practice, risk poor quality leading to invalid assessment. High-quality test material is expensive. One resource saving strategy is to share test material across institutions within domains. Within the medical domain, for example, assessment alliances are created that share written and performance-based assessments across member institutions, both nationally (www.medschools.ac.uk) and internationally (www.idealmed.org). Unfortunately, cross-institutional collaborations occur rarely in educational practice.

That *assessment drives learning* has been documented since very long time (Frederiksen 1984). A distinction is made in pre-, post- and pure learning effects (Dochy et al. 2007). A learner will prepare for an assessment (pre-learning effect) or may learn from the feedback of the assessment (post-learning effect). Experimental research has shown a consistent effect that when instruction is paired with assessment, learner performance is improved (Karpicke and Roediger 2008). This is the pure learning effect also called the testing effect. It has proven to be a robust effect across a range of different educational settings (McDaniel et al. 2007) and different methods of assessment (Agarwal et al. 2008), including performance assessment (Kromann et al. 2009). Pre-learning effects can be very diverse and often promoting poor learning strategies (Cilliers et al. 2012). Providing feedback to promote a post-learning effect may not always be effective. This will be further discussed in the section on the assessment for learning perspective.

Unstandardized assessment directly assessing performance in work settings (the stimulus format) completely relies on professional judgement of assessors having observed the learner. This is usually captured by holistic judgements using generic rating scales, questionnaires or narrative comments (the response format). As soon as holistic judgement is used, bias is introduced. For example, the 'failure to fail' is a well-known problem in performance assessment (Dudek et al. 2005). Assessors tend not to use the lower end of a rating scale, probably due to adverse consequences of a negative judgement. This is the 'leniency effect' in performance assessment. There are many other rater effects and those are probably all in operation when a holistic performance judgement is made (Murphy and Cleveland 1995). Assessors are not passive instruments, who can be easily calibrated to represent a 'true score' as assumed in psychometric theory (Govaerts et al. 2007). Their judgement will be influenced by their personal experience and expertise, by the work context and by the relationship with the person being assessed (Berendonk et al. 2013). *Therefore*, *bias is a natural given in any form of judgement*. The classic response to the reduction of bias is to 'harness' the judgement by making it more analytical, for example, by standardizing the performance task, by formulating strict performance criteria operationalized in checklists, followed by training programmes trying to calibrate the assessors. Performance observation in real practice is by definition not standardized. In the same vein, complex skills (e.g. communication, collaboration, professionalism, leadership) are extremely difficult to define in atomistic elements. Attempts to such definitions lead to reductionist representations of the construct being assessed and when implemented in assessment practices then

lead to trivial performance by learners complying with the strict criteria. In habitual performance assessment, we need other strategies to deal with the natural inherent bias. We suggest two approaches.

The first applies the first principle discussed and that is sampling. By sampling a number of observations from different assessors, variation between assessors will average out. This is confirmed by considerable research. Several studies based on large data sets indicate that very reasonable performance samples lead to sufficient reliability (Wilkinson et al. 2008; Moonen-van Loon et al. 2013). For example, if we assess the performance of a learner in a practice setting, we need some eight observations (Van der Vleuten and Schuwirth 2005). Similarly, if we assess the performance of a learner through a multisource feedback, somewhere between six and ten raters may suffice (Wood et al. 2006). Sampling may therefore be an important strategy for reducing assessor bias.

A second strategy is of a completely different nature and applies particularly when information is aggregated across different (assessment) sources into a high-stake pass/fail or promotion decision. Driessen et al. (2005) suggest using procedural strategies that are derived from qualitative research to build rigour to the assessment. An example may clarify this. When a portfolio is used for aggregating relevant information on the performance of a learner, that portfolio needs to be judged. It is possible to think of many procedural measures that bring credibility or trustworthiness to a decision made over the quality of the portfolio (qualitative research strategy in brackets):

- Having a committee of (independent) experts (stepwise replication)
- Increasing size of the committee (stepwise replication)
- Tailored increased volume of expert judgement and deliberation proportional to uncertainty of information at hand (triangulation)
- Justification of decisions (thick description)
- Appeal procedures (audit)
- Previous feedback cycles (making decisions unsurprising) (prolonged engagement)
- Incorporation of learner view (member checking)
- Training of examiners (prolonged engagement)
- Scrutiny of committee inconsistencies (structural coherence)

In this way, an essentially subjective professional judgement is fortified alternatively, not by standardization neither by objectification but by due process measures. By doing so the holistic nature of what is being assessed is maintained, and trivialization of the learning processes to achieve these complex skills is avoided. In essence, what is important is *not* to ban subjective judgements from the assessment process as is done traditionally but to use professional judgement whenever they are appropriate. Professional judgement is the core of expertise in many professional domains, so should it be in assessment as well whenever it is appropriate.

In unstandardized assessment, formative and summative functions are typically combined, and feedback is given to the learner (Norcini and Burch 2007). Therefore, the role of the interaction between assessor and learner is crucial for the success of

unstandardized assessment. The way feedback is given and received really determines the value and the quality of the assessment. Unlike standardized assessment where we enhance quality through quality assurance (we can 'sharpen' the instrument), in unstandardized assessment *the users of the instrument are eminently important* (so we have to 'sharpen' the people involved). Both feedback giving and feedback reception are skills that need to be developed. In a study on the success of implementing work-based assessment on a large scale in postgraduate medical training, buy-in from the supervisors was key to the success of it (Fokkema et al. 2013). When the people are important, then we need to invest in them. Capacity building becomes important. Teachers, supervisors, co-workers and learners themselves need to be prepared and trained for their role in the assessment. The purpose is less to standardize or to calibrate assessors but to make them effective feedback givers. Teaching and assessment roles become very intertwined.

A famous quote by Einstein states: *Not everything that counts can be counted, and not everything that can be counted counts*. Assessment is traditionally associated with quantification, with numbers, scores and grades. Complex skills and behaviours, however, are very difficult to quantify, and when so they provide little information for feedback and remediation (Shute 2008). Research shows that learners appreciate narrative feedback because it is more useful to them (Govaerts et al. 2005; Ellis et al. 2008; Pelgrim et al. 2011). In performance assessment therefore *narrative information carries a lot weight*. Narrative information provides the nuance that numbers are not able to provide. Putting a metric on something that is hard to capture in a metric may again lead to reductionist practices, for example, students hunting for grades, not accepting lower grades or adherence to the bare minimum only. The implication is that we should invite assessors to use narratives, to describe behaviours in their feedback whenever that is appropriate. With performance assessment, we slowly move from numbers to words, a movement that may have quite some implications (Govaerts and Van der Vleuten 2013).

Research indicates that the provision of feedback does not guarantee its use (Hattie and Timperley 2007; Harrison et al. 2013). A lot of feedback is simply ignored (Hattie and Timperley 2007), all depending on the kind of feedback (Shute 2008), its credibility and the culture in which it is given (Watling et al. 2013; Harrison et al. 2014). Emotions also play an important role (Sargeant et al. 2008) as well as reflection on the feedback (Sargeant et al. 2009). We may conclude that *effective feedback needs to be scaffolded* by educational arrangements in which reflection and follow-up occur. One way of scaffolding is to create dialogues around feedback in social interactions. This can be done in peer groups or by mentoring. Building entrusted relationships, such as in mentoring, in which feedback and follow-up are discussed with learners is a very powerful approach to feedback use (Driessen and Overeem 2013).

Finally, *there is no best method of assessment*; there is no magical bullet that can do it all. Every single assessment approach or method will always be a compromise on its quality characteristics (Van der Vleuten 1996). No single method may cover the entire competency pyramid, no single method may be perfectly reliable, and no single method may provide all encompassing feedback. Good assessment requires

a combination of different assessment methods. To assess the entire competency pyramid, we need multiple methods and we need to combine information across multiple assessment sources.

28.3 Perspective 2: Assessment for Learning

The first assessment perspective discussed important features of assessment of learning. When students have passed a test that is used to make summative decisions, for example, certification, they tend to ignore the feedback coming from it (Harrison et al. 2013, 2014). The practical implications are manifold, both practically and conceptually. From a practical perspective, it is important to align the instructional objectives with the way the assessment is done. When curriculum objectives and the assessment are misaligned, the assessment generally prevails, in many times leading to undesirable learning strategies by students. It is important therefore to verify the effect of assessment on the learning of students. From a conceptual viewpoint, the close link between assessment and learning invites us to think about assessment as part of the instructional arrangement and as part of the learning process (Boud and Falchikov 2007). This is the assessment *for* learning concept, the second assessment perspective in this chapter. Viewing assessment as an educational design problem has phenomenal consequences. How does the assessment fit in the instructional plan? How is feedback given and used? What does the scheduling need to be in time? How do methods map to certain competencies to be achieved? And so on. Assessment as an educational design issue needs further attention and more research. In the following, we will clarify the concept of assessment for learning and discuss strategies that teachers and students can use in making assessment beneficial and motivating for learning.

28.3.1 Strategies to Enhance Assessment for Learning

To define assessment for learning, we will refer to the definition of the Assessment Reform Group: 'Assessment for learning is part of everyday practice by students, teachers and peers that seeks, reflects upon and responds to information from dialogue, demonstration and observation in ways that enhance ongoing learning' (Assessment Reform Group 2002). This definition implies that assessment for learning can vary on a continuum from informal 'on the fly' activities – which means that teachers and students continuously interact during the assessment process – to formal embedded activities that are consciously organized, for example, a self- or peer assessment (Shavelson et al. 2008). Particularly the following situations are illustrative for assessment *for* learning (Clark 2010):

– Students are engaged in a process that focuses on metacognitive strategies.

Table 28.2 Strategies to enhance formative assessment

Strategies	Role in formative assessment
Providing feedup, feedback and feedforward	Closing the gap between what learners already know and what they have to know by providing information to the learner that changes or stimulates behaviour
Rich questioning	Provides insight in learners' thinking to enable timely interventions, to refute misconceptions and promote deeper learning
Assessment dialogues	Effective for clarifying learning objectives and the establishment of criteria for success by scaffolding information. Helpful in gathering information about students' understanding and to ensure that students achieve the learning objectives
Reflective lessons	A well-considered combination of several assessments in one lesson to gather information about the development of the learners to choose the next step of instruction
Self-assessment	Provides the learner with information about his or her progression by relating products to learning objectives
Peer assessment	The involvement of peer learners in the assessment of a learner's progression stimulates the understanding of learning objectives and criteria
Rubrics	By describing the levels of attainment for different criteria, transparency is provided to communicate about criteria and expectations
Formative use of summative assessment	Evaluating summative assessments with students provides insight in what learners know and what they not yet know

– Students are supported in their efforts to think about their own thinking.
– Understand the relationship between their previous performance, their current understanding and clearly defined success criteria.
– Positioned as the agent improving and initiating their own learning.

Assessment for learning is often referred to as formative assessment. Formative assessments might be integrated in all learning situations and enhance all the teacher and learner activities that provide information that can be used to adjust learning. The most effective strategies for formative assessment are described in a thorough review (Sluijsmans et al. 2013). These strategies are summarized in Table 28.2. We will discuss four strategies in more detail: feedback, self-assessment, peer assessment and rubrics.

28.3.2 Feedback

Feedback is seen as the most effective method to make assessments formative. Formative feedback represents information communicated to the learner that is intended to modify the learner's thinking or behaviour for the purpose of improving learning (Shute 2008). Feedback becomes formative when students are provided

with scaffolded instruction or thoughtful questioning that served as a prompt for further enquiry, which then closes the gap between their current level of understanding and the desired learning goal (Clark 2010). Effective feedback includes two types of information: verification and elaboration. Verification is defined as the simple judgement of whether an answer is correct (also known as knowledge of results). Elaboration is the informational – and therefore more formative – aspect of the message that provides relevant cues to guide the learner towards a correct answer. Feedback will be effective if it answers three questions asked by a teacher and/or by a learner: Where am I going? How am I going? and Where to next? (Hattie and Timperley 2007). This gives subsequently information about the understanding of the learning objectives (feed up), information about the progress made towards the learning objectives (feedback) and information about the activities that need to be done to make progress (feed forward).

Providing feedback may not always be effective. There should be a coordinated plan with clear and decisive statements regarding feedback scope and functions, content, timing, presentation, conditions and the actors (Narciss 2013). Black and Wiliam distinguish three main actors playing a role in answering these three questions: the teacher, the learners and the peers (Black and Wiliam 2009). The teacher plays a role in clarifying and sharing learning intentions and criteria for success, engineering effective classroom discussions and other learning tasks that elicit evidence of learners understanding and providing feedback that moves learners forward. The peers are instructional resources for one another, and the learner is the owner of his own learning.

Shute (2008) provides a very interesting overview of guidelines that can be taken into account in feedback practice. This overview presents guidelines in terms of: things to do, things to avoid, timing issues and learner characteristics.

28.3.3 Self-Assessment

To become successful lifelong learning professionals, students are required to keep up with the latest developments in their expertise and to engage in a variety of tasks that foster continuous self-improvement (Bjork 1999; Boud 2000). Excellent sportsmen serve as a classic example of learners who continuously improve their performance by setting new goals and persisting to achieve these. Self-assessment is effective to foster self-improvement driven by the central question: How can I improve previous performances? (Eva and Regehr 2005). Self-assessment refers to the involvement of learners in making judgements about their own learning, particularly about their achievements and the outcomes of their learning (Boud and Falchikov 1989). Self-assessment is not a new technique, but a way of increasing the role of students as active participants in their own learning (Black and Wiliam 2009), and is mostly used for formative assessment in order to foster reflection on one's own learning processes and results. In a self-improvement model, students are presented with professional tasks that need to learn. For the self-assessment,

students are encouraged to select task aspects they would like to improve. After the assessment, students can self-assess their performance based on the selected task aspects and predefined standards. A new learning cycle starts when further development is needed. Most surprisingly, in research on self-assessment, this cyclic process of self-improvement is rarely used (Falchikov and Boud 1989; Gordon 1991). As a consequence, professional development becomes a unique learning path for each individual learner (Handfield-Jones et al. 2002). However, self-improvement assumes self-regulated learners, who are able to self-assess their performance (Boud 1990; Zimmerman 1990). Unfortunately, to date there is little empirical evidence that (starting) professionals are indeed capable of continually self-regulating their self-improvement process (Kruger and Dunning 1999; Regehr and Eva 2006). Abundant research has shown that we are poor self-assessors (Eva and Regehr 2005), so self-assessment should always be triangulated to other forms of assessment.

28.3.4 Peer Assessment

Falchikov defines peer assessment as the process through which groups of individuals rate their peers (Falchikov 1995). This exercise may or may not entail previous discussion or agreement over criteria. It may involve the use of rating instruments or checklists which have been designed by others before the peer assessment exercise or designed by the user group to meet its particular needs. Extensive literature reviews show that peer assessment is predominantly quantitative, such as peer ranking, peer nomination and peer rating (Sluijsmans et al. 2002; Van Zundert et al. 2010). However, for peer assessment to be effective for learning, it is recommendable that peer assessment is approached as a complex professional skill that requires intensive training. An example how students can be trained in peer assessment skills and how this affects learning can be found in Sluijsmans et al. (2002). First, they conducted a literature review and expert interviews to make an overview of the important peer assessment skills. This resulted in a peer assessment model in which three main skills are taken into account. These skills are (1) defining assessment criteria, thinking about what is required and referring to the product or process; (2) judging the performance of a peer, reflecting upon and identifying the strengths and weaknesses in a peer's product and writing an assessment report; and (3) providing feedback for future learning, giving constructive feedback about the product of a peer. Subsequently, a training programme for peer assessment was designed according to instructional design principles. This training programme consists of a number of peer assessment tasks, which are fully embedded in the curriculum. The study revealed that the qualitative assessment reports written by the students showed that the experimental groups surpassed the control groups in the quality of the assessment skill. As a result of the training, students from the experimental groups also scored significantly higher grades for the end products of the course than students from the control groups.

28.3.5 Rubrics

For constructive alignment, rubrics are a good tool to support assessment *for* learning as well as assessment *of* learning. Rubrics are very suited to assessment for learning as they can be made or adapted for many levels and provide both criteria and learning objectives. Although they appear in many forms and sizes, the best-known type is a grid, which allows teachers to align levels of performance with criteria by using descriptors. The descriptive language that explains characteristics of work or performance at increasing levels of quality makes rubrics informative tools for feedup, feedback and feed forward. By using them in a general way, they become efficient tools in assessment programmes as they judge quality across similar tasks for different courses. Rubrics allow teachers to communicate about standards and aims in a coherent and clear way. The transparency provided by rubrics can be used to support feedback and self- and peer assessment. Providing a rubric with samples of strong and weak work increases the transparency. A rubric provides insight in the complexity of a task and helps learners in answering the questions of where they are and what they have to do next to achieve higher quality (Burke 2008). In order to develop a feeling of ownership, it is a good idea to try and develop a rubric together with teachers and learners. Bottom-up use of rubrics, which implies the development of a rubric together with teachers and learners, is preferred above top-down use of rubrics. The bottom-up use results in feelings of ownership and a more and better understanding of the learning objectives (Burghout 2012). Arter and Chappuis identify the following basic steps in developing rubrics: (1) identify aims/learning objectives, (2) identify observable attributes that you want to see (and don't want to see) demonstrated, (3) brainstorm characteristics that describe each attribute and find ways to describe levels for each attribute, (4) write precise descriptors for lowest level and highest level, (5) write descriptors for the remaining (intermediate) levels and (6) collect samples of work which exemplify each level to become benchmarks (Arter and Chappuis 2006). Providing feedup, feedback and feed forward in combination with the use of rubrics is a strong combination of tools for assessment for learning. It can be used in supporting other formative methods like self-assessment, peer assessment, reflective lessons and assessment dialogues.

28.4 Perspective 3: Assessment as Learning

28.4.1 A Programmatic Approach Where Assessment of and for Learning Are Merged

The literature on assessment is virtually all geared towards the study of individual assessment methods and how to optimize them. As is clear from the above, every individual method of assessment has clear limitations and is far from perfect. This led to the suggestion to not optimize the individual method but to optimize the

collection of methods in a programme of assessment (Van der Vleuten and Schuwirth 2005). In a programme of assessment, methods of assessment are purposefully selected, mainly because of their intended positive effect on learning (Schuwirth and Van der Vleuten 2011). A curriculum is a good metaphor. In the past a curriculum consisted of individual teachers or departments each doing their course or module with little integration across courses. The set of courses made up the curriculum, and the integration was left to the learner when confronted to professional tasks or to work. Modern curricula are planned according to a master plan, are integrated, are governed, are evaluated and are modified accordingly. The same strategy can be taken with assessment. Within a curriculum a set of assessment methods are chosen deliberately and coherently based on intended learning effects. Any method of assessment may be used (classic or modern) all depending on its purpose within the total assessment programme. For example, one deliberately requires learners to present here, to verbalize there, to synthesize then, to write up subsequently and so on so forth. The programme is evaluated regularly and modified accordingly. After the suggestion to start thinking in assessment programmes, Baartman et al. developed a set of criteria of assessment programmes (Baartman et al. 2006) and a self-evaluation instrument to judge the quality of these programmes (Baartman et al. 2011). Dijkstra et al. (2012) continued to develop a set of 73 guidelines for designing assessment programmes (Dijkstra et al. 2012). Van der Vleuten et al. (2012) proposed a model of what has been called programmatic assessment. We will describe this model and end with an illustration of an implementation of the model in a concrete setting.

28.4.2 Key Elements of Programmatic Assessment

In programmatic assessment, a number of basic tenets are formulated that are inspired on the set of principles that are formulated earlier (Table 28.1):

- Each individual assessment moment is but one datapoint.
- Each individual datapoint may consist of any method, is closely linked to the educational programme and always provides meaningful feedback to the learner.
- A continuum of stakes replaces the formative-summative distinction.
- Stakes and number of datapoints are proportionally related; a single datapoint is by definition low stake.
- Information is aggregated across datapoints and across meaningful entities (usually a competency framework).
- Learners are supported in feedback use and follow-up (usually through a mentoring system).
- High-stake (promotion or selection) decisions are based on many datapoints and are taken by a (independent) committee.

In this model individual datapoints of assessment are maximally optimized for learning. Every assessment provides feedback to the learner in whatever way that is

appropriate within that method (quantitative and/or qualitative). The individual datapoint is low stake. Usually, pass/fail decisions are not taken. The individual datapoint serves to provide information on the learner, not on pass/fail decision-making. The decision-making on passing or failing is done at the programme level when many datapoints are gathered. High-stake decisions, for example, promotion to the next year, are ideally preceded by intermediate decisions on learner progress. The high-stake decision-making should not really come as a surprise to the learner. Learners reflect on their feedback and progress. They are supported in that process through a dialogue, usually a mentor. Progress is discussed regularly and plans are made for further study. This may include remediation on certain elements that have shown insufficient progress. The collection of datapoints is meaningfully aggregated, for example, across certain competencies and assessed by a committee of experts. Committee deliberation will be proportional to the clarity of the information being assessed. If the assessment information triangulates in a clear picture (which will be the case for the far majority of learners), then the decision-making will be a swift process. On the other hand, more difficult cases will require the committee to deliberate extensively. The ultimate decision taken can be justified and defended by the committee.

28.4.3 A Best Practice of Programmatic Assessment

An illustration may provide more clarity on programmatic assessment. Maastricht University has a graduate entry programme in medicine. This is a 4-year training programme in medicine and research. On top of the medical degree, students receive a Master of Science degree in clinical research. Matriculating students have a previous bachelor or master degree in any of the biological sciences (n = 50). The first 2 years consist of theoretical training through problem-based learning, the latter 2 years of clinical work-based learning and research projects. The curriculum and the assessment are structured according to a competency framework (CanMEDS) (Frank and Danoff 2007). Within units, the assessment consists of traditional end-of-unit assessment (in written or oral form), assignments and projects and peer and tutor assessment. All assessment is feedback oriented. There are no pass/fail decisions. On top of the modular assessment, there is continuous longitudinal assessment. One form is through progress testing (Wrigley et al. 2012). A progress test is a comprehensive multiple-choice test representing the end objectives of medical training and contains all disciplines. Most items are problem-oriented scenarios. One could compare a progress test to a final examination, but that final examination is given to all the students in the curriculum. This is repeated four times per year. Every new test has newly written items. Students cannot really prepare for a progress test. What would they study? Anything can be asked. There is also no need to study for it as well. If a student regularly studies, scores will grow automatically. Every 3 months all students can see how they have grown in total and in all parts of the blueprint (disciplines and organ system categories). Feedback is provided

through an online system where students may analyse their (longitudinal) performance in any area. Progress testing provides a wealth of information to the learner on their achievements in the cognitive domain, while at the same time prevents test-directed studying for the short term. Another longitudinal assessment is the assessment on their competencies through self, peer and tutor assessment. During their workplace attachments, they are regularly observed and feedback is given. A number of different work-based instruments are used (direct observation instruments, multisource feedback, video assessment, assignments and project assessments). The student assembles all the feedback in an electronic portfolio. The portfolio is a portal that serves as a repository, an organizer for feedback reception (e.g. forms may be completed on hand-held devices; feedback questionnaires are distributed to assessors), and aggregates information across different assessment sources into competency-based quantitative and qualitative feedback reports. Every student has a mentor who has access to the portfolio. The mentor and the student regularly meet. Progress is discussed and (remediation) plans are being made and monitored. At the end of the academic year, the portfolio is assessed for promotion to the next year. The mentor writes a recommendation that may be annotated by the student. The pass/fail (and distinction) decision is given by a committee. The committee consists of all mentors, but in the actual decision-making, the own mentor of the student has no say. The committee extensively deliberates only on a few cases. Students may appeal to committee decisions.

The programmatic assessment model optimizes both learning and decision-making. Learning is optimized because the assessment is information rich. Measures are taken that facilitate the use of feedback. Self-directed learning is facilitated by continuous reflection and feedback. Remediation, as opposed to the classic repetition (in resits or in redoing the course), is an on-going and personalized process. The decision function is removed from the individual datapoint, and therefore reliability is of less concern. The biggest concern at the individual datapoint is the provision of meaningful information for learning. The decision-making function is optimized due to the use of many (rich) datapoints. Such richness of information can never be replaced by any other single assessment such as a final examination. Programmatic assessment has been implemented in a number of settings across the world, albeit in health-related fields so far (Dannefer 2013; Bok et al. 2013). The first research shows that programmatic assessment may work in higher education (Bok et al. 2013; Heeneman et al. Under editorial review), but the quality of implementation is kernel to its success. Getting high-quality feedback from teachers or fieldwork supervisors is a challenge. Creating and getting buy-in from teachers are important. The users (both teachers and learners) should understand the assessment function and their role in the assessment. Convincing teachers, for example, that they may not fail students is not an easy task. Cost is another issue to consider. Giving feedback takes time; a mentorship programme is resource intensive. Programmatic assessment should therefore be part of a full curriculum concept, where the assessment is part of the learning concept. When fully integrated in the learning concept, assessment as learning will be achieved. When implemented carefully, learners tend to become real feedback seekers (Altahawi et al. 2012).

28.5 Conclusions

In this chapter we outlined three perspectives on assessment and their implications for educational practice: assessment *of* learning – with a focus on making sound and reliable decisions about students' learning – and assessment *for* and *as* learning, both focused on enhancing students' further professional learning. Figure 28.2, which is based on the model presented by Clark (2010), summarizes the main messages regarding each perspective in relation to the triangle assessment, curriculum and learning/teaching. From Fig. 28.2, two important conclusions can be drawn. A first conclusion is that assessment of, for and as learning can and should be aligned within the whole educational system. When this alignment is assured, appropriate decisions about students' professional learning can be made which are also informative for subsequent learning in which students are seen as active participants who are made responsible for their own learning. A second conclusion is that strong assessment practice involves intense collaboration between students, staff and

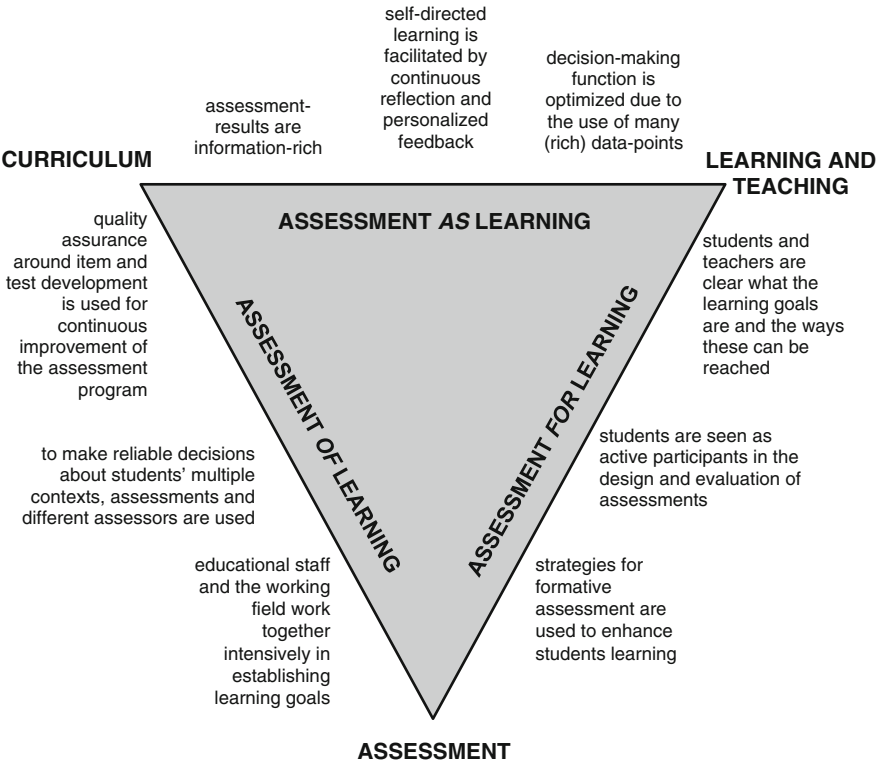

Fig. 28.2 Assessment of, for and as learning to assure constructive alignment (Clark 2010; Adapted by the authors)

working field. Since many professions evolve rapidly, a well thought-out quality assurance system is needed in which learning goals, and the consequences for assessment design are evaluated on a regular basis.

We hope we clarified our basic view on how assessment may support the learner and the learning process. In all sectors of education and in all parts of the world, competency-based assessment is being introduced. Our educational philosophy has moved from a behaviourist view on learning to a constructivist view on learning. But many assessment practices are still behaviouristic and more appropriate for a mastery learning conception. Given the driving effect of assessment on learning, we would argue that the success of introducing competency-based education depends on the quality of the assessment in such education. Competency-based education addresses learning of complex skills. Competencies typically have a behavioural aspect that can only be assessed through observation and professional judgement. Such skills can only be developed with vertical integration in longitudinal lines of training with proper feedback cycles and follow-up. Assessment may provide and should provide the right scaffold for this learner support. To be successful, assessment should be part of the design process of a training programme, intrinsically linked to the on-going education, providing feedback for learner support and providing accumulating information for monitoring and decision-making over learner progress.

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Chapter 29
Assuring Quality in Competence Assessments: The Value Added of Applying Different Assessment Approaches to Professional Education

Sigrid Blömeke

29.1 Introduction

The move towards competence-based vocational and higher professional education in many countries (Mulder et al. 2007) raises the question whether these changes lead to an increase in outcomes on the students' side – in particular because the reforms claim to target *learning* rather than counting seating time in the classroom as in traditional approaches. Thus, in parallel to educational reforms, a growing interest in methodological approaches to the assessment of competencies can be noted (see, for example, Boritz and Carnaghan 2003).

The assessment of competencies acquired in vocational and higher professional education goes beyond typical methodological difficulties related to any assessment of behaviour, personality or capability where doing an assessment as reliably as possible is of upmost concern (Lord and Novick 1968). To end up consistently with the same result under else the same conditions (*ceteris paribus*) increases the trustworthiness of a result and allows for the examination of its relation to other measures without too much distortion through measurement error.

Classical test theory (CTT) provides a useful tool for the development of a competence assessment in this respect. Because of the theory's focus on the assessment instrument as a whole (instead of on single items), it is possible to analyse the reliability of the data gathered with this instrument. *Cronbach's alpha* has become by far the most popular reliability estimate in this context (Cronbach 1951). The parameter estimate is easy to understand and easy to calculate due to its ready-made inclusion in many popular software packages such as SPSS. Its application can therefore be regarded a well-established standard in research on vocational and higher professional education.

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Although reliability is a crucial quality criterion in the assessment of competencies acquired in vocational and higher professional education, all sorts of trade-offs and problems may occur if it is applied too intensely or in the meaning of CTT only. Quality assurance in competence assessments is difficult and requires drawing on a range of different methodological approaches including generalizability theory (Cronbach et al. 1972) and item response theory (Reckase 2009). This issue shall be discussed and demonstrated in this chapter with the help of several examples from competence-based professional education at the secondary and post-secondary vocational and higher education level. In a first step, the challenges of competence assessments are summarized. In a second step, by means of a concise review of the literature on methods applied in competence assessments, the specific value of item response theory and generalizability theory is presented and exemplified with respect to vocational and higher professional education. In a final step, open questions and concerns are discussed.

This chapter complements thus the chapter of Barabasch (Chap. 30), in particular Sect. 30.3, about the assessment of competencies as outcomes of vocational and higher professional education. Barabasch describes the regulations and practices prevalent in Europe, whereas in the present chapter, the methodological challenges of developing reliable and valid competence assessments are analysed. In addition, this chapter complements the one of Van der Vleuten et al. (Chap. 28) on competence assessment as learner support in education. Whereas Van der Vleuten et al. distinguish between assessment of learning, for learning and as learning and focus particularly the latter two, the present chapter focuses the first one and presents modern approaches to accomplish reliable and valid assessments.

29.2 Overview About the Challenges to Assess Competencies

Competencies are complex constructs. In the following the dimensionality of their nature is analysed and what it means for the development of reliable and valid assessments (Sect. 29.2.1). After that, further methodological challenges are discussed which stem from educational attempts to foster competence development in group settings, for example, in classrooms, which violates the traditional assumption of independence of measures on the individual level (Sect. 29.2.2).

29.2.1 Inherent Multidimensionality of Competence Acquired in Higher Professional Education

The methodological difficulty of competence assessments is related to the field of education as the ‘host discipline’ of competence assessments in contrast, for example, to psychological measurements. Psychology typically deals with the

assessment of individual differences on well- and narrowly defined traits such as ‘assertiveness’ as one of the facets of extraversion (Costa and McCrae 1985). In contrast, competence is in most definitions regarded a broad construct and – as ‘an underlying characteristic of an individual that is causally related to criterion-referenced effective and/or superior performance in a job or situation’ as defined, for example, by Spencer and Spencer (1993) – typically multidimensional by nature. Competence then includes more than cognitive indicators such as systematic knowledge in one domain only but also cognitive skills closely related to the situations to be mastered by a professional on the one hand (see, for example, Blömeke et al. 2015) and affective-motivational characteristics such as beliefs, attitudes, motivation and/or volition on the other hand (see, for example, Weinert 2001).

Just imagine a mathematics teacher who needs mathematics content knowledge in her teaching but also knowledge as to how to represent the content appropriately to children of different age with their different preconditions and abilities to learn and develop which is called mathematics pedagogical content knowledge, furthermore the skills to perceive and interpret a classroom situation, in particular students’ replies accurately, and then to make decisions. Furthermore, whereas these knowledge and skills required to perform consistently on a high level are domain-specific, the teacher needs also knowledge and skills of generic nature. Disturbances have to be prevented which is called classroom management, in addition to communication with colleagues and parents, participation in and design of school evaluations, planning of extracurricular activities and so on. Thus, mathematics teachers’ professional competence does not only consist of many different dimensions, but these are again multidimensional in themselves as one can easily imagine.

From a measurement point of view, this multidimensional nature of competencies acquired in vocational and higher professional education represents a huge challenge given that one of the classic principles upon which measurement is based is the principle of unidimensionality (Blömeke et al. 2015). This principle states that the different components (e.g. items) of an assessment should reflect only one underlying dimension. This does not imply that the different components should in themselves be simple; they can, for example, be complex authentic tasks (Gustafsson and Åberg-Bengtsson 2010). However, a strict application of the principle of unidimensionality rarely is possible then, because method variance and variance stemming from additional dimensions besides the one to be examined distort the unidimensionality assumption.

CTT and in particular the application of Cronbach’s alpha reach their limits in this case since item homogeneity is a necessary but often overlooked precondition for their application. Even worse, multidimensionality does not necessarily lead to a low Cronbach’s alpha estimate but, in contrast, to overestimation of reliability because the parameter estimate is strongly inflated by test length (Schmitt 1996), and assessments of competencies tend to be long to cover all the different dimensions in question.

The typical approach to deal with this problem, if it is recognized at all, is therefore to apply the principle of unidimensionality in a strict way by splitting the complex construct of competence into more narrow sub-constructs, each of which is

homogeneous in itself and, thus, satisfies the assumption of unidimensionality (Blömeke et al. 2015). In case of mathematics teachers, this would mean to have a separate measure not only for mathematics pedagogical content knowledge, for example, but because of the implicit multidimensionality of this construct for very narrow sub-dimensions such as knowledge about children's development of number competencies at the age of 3–6. While such approaches, if followed up to a certain depth, typically are successful in the sense that statistical criteria of unidimensionality are met, the approach in itself may be self-defeating because the construct – in this case mathematics pedagogical content knowledge – is splintered into pieces whose validity can be questioned (Gustafsson 2002).

29.2.2 Involvement of Multiple Levels in the Process of Competence Development

Since the assessment of competencies is part of educational endeavours, the final objective of an assessment in the fields of vocational and higher professional education research is often to identify educational characteristics which foster the development of a competence – and this typically happens in group settings such as classrooms or youth programmes (Raudenbush et al. 2010). This is again in contrast to much of psychological research. Whereas psychological measurement often has a focus on assessing individual differences on a construct and how to explain these differences by individual preconditions such as intelligence, motivation or personality traits, *educational* measurement typically has a focus on the group level and assessing the effects of classroom characteristics such as instructional quality on individual outcomes such as competencies.

To exemplify this focus again with the example of mathematics teachers and their professional competence, major research questions of interest in educational measurement are how different approaches to teacher education lead to different outcomes. To what extent do the quantity (e.g. the amount of classes taken) and the quality (e.g. the teaching methods applied) of opportunities to learn mathematics pedagogical content knowledge result in differential strengths and weaknesses of mathematics teachers at the end of their study programme? To what extent do disciplinary-based (e.g. taking classes in algebra separately from classes in teaching algebra and these again separately from practising it in schools) or competence-based approaches which are of a more integrated nature result in differential strengths and weaknesses of these teachers? The large international 'Teacher Education and Development Study: Learning to Teach Mathematics (TEDS-M)' has provided many results in these respects (Blömeke et al. 2012; König and Blömeke 2012).

The group setting of vocational and higher professional education in which teaching and learning happens adds the complexities of nested data on the one hand

and of how to exam reliably and validly effects in natural settings on the other hand to the difficulties of competence assessments pointed out above. Most statistical approaches are based on the assumption of randomly drawn individuals which are independent from each other, as it is typical for the assessment of individual differences on a psychological construct. This assumption of independence is often violated in group settings because members of each group tend to be more similar to each other as if they were drawn randomly from the overall target population.

Just imagine the case of a specific college of education in a country that provides mathematics teacher education. It is very likely that the majority of its teacher students grew up within a certain range around this college. This means that the characteristics of this neighbourhood are most probably overrepresented in this group in contrast to a group drawn from a different neighbourhood. Furthermore, colleges of education differ in reputation and attractiveness. A large elite inner-city college can recruit from a larger pool of applicants than a small college in a rural area. The first college can be more selective in terms of school grades or study motivation. This again means that the group of future teachers entering this college is more similar internally than compared to cognitive and motivational preconditions from other colleges of education.

This correlation of characteristics within a group – called intra-class correlation (Bryk and Raudenbush 1992) – increases substantially the risk of false conclusions about the competence acquired because traditional estimations, developed on the psychological premise of individuals drawn independently from each other, produce standard errors of an assessment result which are too small. These lead in turn to a higher probability of rejection of the null hypothesis which means, for example, that a comparison of two approaches to mathematics teacher education very quickly leads to significant differences although these may only reflect differences in the class composition, not in the approaches to teacher education.

If researchers try to deal with this problem by aggregating the individual data available on the classroom level and then comparing the two approaches to mathematics teacher education, which was very common in educational research not long ago, statistical power is reduced because instead of having data from, for example, hundreds of individuals which have gone through the two teacher education approaches, only data from some tenth of classes are available. This may in turn lead to an underestimation of the relationship between teacher education and mathematics teachers' competence. Furthermore, the individual variability of the outcome – teacher competence – in the two groups gets lost, and, even worse, the variables which describe the characteristics of the two mathematics teacher education programmes may change their meaning (Bryk and Raudenbush 1992). For example, prior mathematics knowledge of an individual teacher is different from prior knowledge of a whole group of teachers. Such composition characteristics have different effects on the outcome than individual preconditions (see, e.g. Blömeke et al. 2012).

29.3 Promising Approaches to Overcome the Challenges of Competence Assessments

The recognition of these challenges has at the same time strengthened the sensitivity to subject-specific and methodological problems of measurements during the past decade – not least because of public debates about the outcomes of international large-scale assessments of student achievement which have been scrutinized in the public media but also in academia. Thus, the challenges have resulted into promising approaches to assure the quality of assessments in ways that help assessing the outcomes of competence-based vocational and higher professional education in a better way. These ways are, firstly, the collaboration of methodological and subject-matter experts; secondly, utilizing technological progress; and thirdly applying different methodological approaches in addition to CTT.

29.3.1 Assuring Quality of Competence Assessments Through Collaboration Across Disciplines

Not long ago, it was quite common that subject-matter experts developed an assessment, and methodological specialists came only into the research process when the data gathered with the new instruments had to be analysed. This has changed. Many subject-matter experts are nowadays willing to collaborate with measurement specialists from early on in the process of test development. This makes the development of competence assessments much more efficient because methodological problems can be addressed already during instrument development. Vice versa, many methodological specialists are now willing to pay more attention to subject-specific issues and to try to solve them on the premises of the previously rather neglected content validity instead of focusing on measurement properties such as reliability or construct validity.

Wilson (2013) and the Berkeley Evaluation and Assessment Research (BEAR) centre were pioneers in this respect. The centre has been developing instruments and analysing data as a collaborative enterprise already since the early 1990s, and this with the particular purpose of identifying the effects of educational interventions in order to inform policymakers. The BEAR centre has therefore become a pioneer in research on ill-defined educational constructs, such as competencies in science education, and in developing statistical models how to reflect the complexities of educational outcomes appropriately.

The centre's integrated assessment system (Wilson and Sloane 2000) departs from a learning progression perspective on the one hand – how to develop a certain competence – and from a validity perspective on the other hand – how to ensure that the assessment covers the content of a competence in its full complexity. A useful tool that reflects the collaborative nature of the research and the intention to

strengthen content validity of complex assessments is, for example, the idea of construct maps developed by the BEAR centre (Wilson 2004).

To define a construct from multiple perspectives which then all have to be taken into account systematically in item development has revolutionized educational measurement and supports the assessment of competencies. Mislevy's (2006) evidence-centred assessment design is a similarly interesting approach to educational testing and flexibly enough to be applied to competence assessments. An example with respect to an assessment of mathematics content knowledge would be to cover not only mathematical *topics* such as algebra or geometry but also *processes* such as problem-solving, modelling and argumentation, as well as *cognitive demands* such as recalling, applying and creating (Anderson and Krathwohl 2001) or types of *representation* such as the symbolic, iconic and enactive representation (Bruner 1966) of a mathematical topic.

Systematically implemented into competence-based vocational and higher professional education research was this collaborative approach within the large funding initiative 'Modeling and Measuring Competencies in Higher Education (KoKoHs)' released in Germany in 2012 (Blömeke et al. 2013). The research programme includes 70 collaboratively organized projects at approximately 50 institutions of higher professional education in Germany (see various chapters from this research programme in Part IV of this volume, e.g. the chapters of Ștefănică et al. (Chap. 39), Spöttl and Musekamp (Chap. 40) and Wuttke and Seifried (Chap. 41)). The programme brings together subject-matter experts from specific fields of study with experts of psychometrics and test development. Thus, it pioneers research on competencies acquired in higher education.

In all KoKoHs projects, competencies are defined by analyzing core curricular requirements at institutions of higher professional education on the one hand and crucial job-related requirements necessary to succeed on the labour market on the other hand, both of which ideally are in accordance with each other (Webb et al. 2012). The KoKoHs projects operate under the assumption that competencies acquired in higher professional education are multidimensional and domain-specific, and therefore they can be distinguished from constructs such as intelligence or basic cognitive abilities. Examples of important results in this respect are reliable and valid instruments that assess, for example, competencies acquired in study programmes provided by economics (Förster et al. 2015), engineering (Neumann et al. 2015) and teacher training in STEM subjects (Dunekacke et al. 2015).

29.3.2 Assuring Quality of Competence Assessments Through Utilizing Technology

Large methodological progress made in the field of educational measurement during the past 10–15 years came through utilizing the progress made in technological respects. It provides not only increased computational resources but also tools for

computer-adaptive testing or the inclusion of innovative assessment formats that facilitate the assessment of complex competencies as they are typical for vocational and higher professional education. However, these technological developments include at the same time again new challenges.

29.3.2.1 Computational Advancements

The need of computational resources in vocational and higher professional education research is huge. For a long time, it was necessary to estimate simplified models because algorithms had to be written by hand and estimated in the very early years of automatic computing with punched cards, later with slow personal computers (Metropolis et al. 1980). Only technological progress made it possible to estimate more complex models that are able to cover the complexities of competence assessments needed nowadays. Such computationally more demanding models can estimate many parameters at the same time, for example, discrimination parameters and guessing effects in addition to item difficulty, and they support latent variable modelling. Latent variables are constructs that cannot be assessed directly but have to be inferred from a larger range of items. The content knowledge of mathematics teachers is, for example, such a construct.

Computational power and statistical progress together make it possible that latent variables today can be defined at the individual and higher levels, that all variables can be continuous or discrete and that indicators also can have different formats (Skrondal and Rabe-Hesketh 2004). This framework offers great flexibility so that it is possible to deal with measurements from many different types of assessment formats and a multitude of fixed or random effects, which sets the stage for reliable and valid assessments of competencies in vocational and higher professional education.

Computer-adaptive testing is one of the further opportunities made possible through technological progress. It can increase the accuracy of test scores while reducing the test burden (Van der Linden and Glas 2000). In traditional paper-and-pencil assessments, many test takers have to work on items that are either way too easy or way too difficult for them because a test has to cover the full range of potential abilities. This misfit may play out negatively with respect to motivation and may result in a rather inaccurate estimate of abilities. Computer-based assessments provide in contrast the possibility to adjust the items to be worked on to abilities shown on those items already solved. The test taker is now working on items more closely related to his or her 'true' ability which avoids the impression of wasted time, and the results represent a very fine-grained picture of these abilities (Gershon 2005). In the USA, most of the primary and middle school assessments on the state level are therefore now delivered as computer-adaptive tests (Stone and Davey 2011).

Furthermore, while most of the technological advantages are linked to the presentation of items – either adapted to the ability level of test takers as discussed above or allowing for including features not available with paper-and-pencils tests such as dynamic representations or videos as discussed below – item scoring also

benefits from computer-based assessments. This does not only apply to multiple-choice items where the advantage is immediately obvious, but recent developments also point to cost-effective and reliable applications to constructed-response items where students are often requested to go beyond cognitive processes such as recalling or understanding but to come up with own solutions. Traditionally, such student answers had to be coded by multiple raters which have introduced additional variance due to disagreement between these. 'Automated' scoring – as it is called in the literature – reduces this problem under the condition that the range of correct answers is clearly defined (Williamson et al. 2010). In language tests this would apply, for example, to assessments of spelling and vocabulary or grammar usage.

29.3.2.2 Innovative Approaches to Competence Assessments

The new technologies make it also possible to include innovative assessment formats that may come closer to the complex objectives of competence assessments such as videos and simulations. Since many researchers agree (Weinert 2001) that competence is a multidimensional construct, a natural conclusion is to include a broad range of instruments that address the different dimensions appropriately. Knowledge tests can be delivered as paper-and-pencil tests including multiple-choice and constructed-response items. Affective-motivational characteristics are typically surveyed with rating scales. Cognitive skills that play out in interactions with situational demands need innovative assessment formats such as video-based performance tests that present authentic situations and require test takers to react to these.

Including their reaction time offers another new type of data that adds more information. An example would be the computer-based assessment that was developed in a follow-up study to TEDS-M that provided the participating early career teachers with an opportunity to anticipate typical errors to a given mathematical topic before they were asked to identify such a typical error under time pressure (Blömeke et al. 2014). The data revealed a strong relation between the competence to identify errors quickly with both mathematical content knowledge and mathematics pedagogical content knowledge. Small mobile technologies such as smartphones or electronic watches provide the opportunity to gather such and other data randomly across many daily situations, for example, about how a test taker is feeling in different situations during the morning, the afternoon and the evening by beeping randomly each day and asking quickly a few short questions (see, e.g., Hektner et al. 2006).

An example of such innovative approaches is the video-based assessment developed in Germany to gather data about preschool teachers' skill to perceive and interpret preschool situations and to plan educational interventions while they are working in complex, heterogeneous and highly unstandardized situations (Dunekacke et al. 2015). A precise perception and an appropriate interpretation of what was perceived should provide a basis to activate preschool teachers' knowledge and to make meaningful decisions (van Es and Sherin 2006). Many hours of

everyday activities in preschools with children at the age of 3–6 years were recorded before three videos were selected on the basis of an expert panel and a literature review (Dunekacke et al. 2015).

The videos included different mathematical topics and contexts of everyday life in preschools, and they were used as item prompts. The participants firstly watched the videos and then worked on predominantly open-response items related to each video, for example, 'Please describe three aspects relevant from a mathematics education perspective in this situation and provide exemplary evidence for each' or 'Please provide two options how to react appropriately in this situation from a mathematics education perspective'. Correct answers would, for example, be 'Different representations of the number are shown' or 'Give an impulse such as: "Who of you is the bigger one?"' Content validity could be confirmed by an expert panel, and also other psychometric properties of the assessment were good (Dunekacke et al. 2015). One of many interesting results from this study was that the planning of educational interventions was not directly related to the preschool teachers' mathematical content knowledge, but this relationship was mediated by their skill to perceive the situations appropriately.

29.3.2.3 New Challenges

These technological and methodological developments in the field of competence assessments leave us with the great challenge of how to combine observational data from complex situated performance assessments, more traditional discrete item measurement of knowledge and other innovative approaches to the assessment of competence in vocational and higher professional education from a methodological point of view. Traditional item measurement provides a lot of discrete information because each item can be worked on independently and provides, thus, new information. In contrast, information from video-based assessments is often strongly linked to the few situations presented. All replies to one video are therefore related to each other and do not provide separate pieces of information. A typical example would be: 'How do you interpret this classroom situation?' and 'What would you do next?' Since the answer to the second question depends on the answer to the first, the information must be collapsed into one answer. As a consequence, the pure mass of information from the traditional assessments with their many multiple-choice and constructed-response items typically swamps the information from the performance assessments with their low number of situations. This, in turn, means that data about situation-specific cognitive skills may be overshadowed by data about the more stable traits such as knowledge.

At the same time, with the use of different types of competence assessments in vocational and higher professional education, a risk of method bias exists in that sense that differences between results obtained with different instruments may represent their methodological differences rather than subject-specific differences between the constructs. Complex fields of measurement problems are entered here, among others the (multi)trait-(multi)method issue of distinguishing constructs from

methods (Campbell and Fiske 1959). It may be that, for example, differences in the results of teachers' paper-and-pencil test of their mathematical content knowledge and a video-based assessment of their skills to perceive and interpret classroom situations just reflect the differences in the assessment approaches used but not differences in the underlying construct which may in reality be the same (e.g. both times mathematics content knowledge).

The only way to be able to distinguish between achievement differences on constructs and achievement differences because of assessment methods used means to develop different methods to measure the same construct and to measure different constructs with the same method. The size of the correlations indicates the validity of the measures then: if the same construct is measured with different methods and their results correlate significantly positively and with large effect sizes, we can assume convergent validity. All other correlations – different constructs measured with the same method and different constructs measured with different methods – need at the same time to be lower. It is obvious that these types of validations are necessary but require enormous research efforts. Whereas it is relatively easy to imagine a video-based assessment that examines mathematics content knowledge, it is much harder to imagine a paper-and-pencil test to examine classroom-specific skills such as perception or decision-making.

29.3.3 Assuring Quality Through the Application of Different Methodological Approaches

Finally, further progress made in the field of competence assessments during the past 10–15 years came from applying further methodological approaches besides CTT in terms of generalizability theory and item response theory. This broadened approach allows for going beyond the assumptions of classical test theory (CTT).

29.3.3.1 Application of Generalizability Theory to Competence Assessments

No matter how well competence constructs were defined and no matter how well instruments were designed to measure competence, the data obtained with these will always be distorted by measurement error because no measurement approach can perfectly reflect reality. A measurement is always an approximation only (Shavelson et al. 1992; Wainer and Thissen 1987). Generalizability theory (GT) extended CTT by decomposing the overall error variance in different sources such as raters or methods (Brennan 2001; Cronbach et al. 1963; Shavelson and Webb 1991).

If several raters code an open-ended answer, they may not always give the same code and introduce, thus, measurement error. If a construct is assessed with differ-

ent methods, these may not result in the same score which again introduces error. If items are changed, the same group of test takers may not end up with precisely the same result – another source of measurement error and so on. GT decomposes the error variance among all potential sources.

These sources can be thought of as a complex sampling problems, namely, the sampling of items, assessment methods, raters and test takers (Shavelson 2012) because a particular competence test can be regarded as one potential instrument out of a broad range of instruments as can items out of the item universe, test takers out of the target population or raters out of the potential range of raters. Error variance can be reduced so that only the variance of interest remains and the reliability of a test score can be estimated then. Testing in this tradition is therefore based on relatively few assumptions only which can easily be met. This recognition of multiple sources of error and their reduction by increasing sample sizes is the major value of applying GT to the assessment of competence in vocational and higher professional education.

Thus, it is also possible to identify an optimal assessment design which is particularly important in the field of competence assessments because rater- and item-sampling effects and temporal instability tend to be large in more complex studies. GT helps in estimating the extent of measurement error as a first step before the effects of redesigning a study by, for example, using more and better trained raters are estimated (Davey et al. 2015). Raudenbush et al. (2010) have recently extended this approach even further towards measurement in social settings such as classrooms by quantifying various sources of error and minimizing measurement error and thus maximizing statistical power and the reliability of group quality measures.

29.3.3.2 Application of Item Response Theory to Competence Assessments

One of the major differences between classical test theory (CTT) and its further development through generalizability theory (GT) on the one hand and modern item response theory (IRT) on the other hand is the way these approaches deal with the information obtained from a measurement.

On the basis of CTT and GT, scores are scaled by summing up or averaging all items. This means that each item of a competence test has the same weight on the final scale and, thus, holds the same amount of information about the underlying competence (although items with larger variance may carry greater weight, but this still ignores systematic differences among items in difficulty and discriminability). In contrast, IRT does not assume that each item holds equal information but estimates the latent trait by applying a probabilistic response model. In many iterative estimations, items are ordered according to their difficulty and weighted so that the best fit of the overall model is accomplished (IRT models differ a bit here because the Rasch model implies that the sum of scores is a sufficient statistic for ability, while this is not so for 2- or 3-PL IRT models; however, for all IRT models, the assumption holds that the estimate of the standard error of measurement is a function of ability). This should facilitate competence assessments.

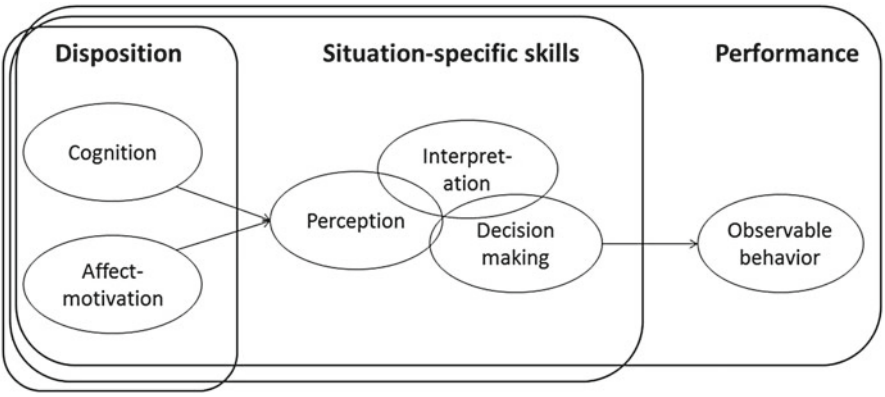

Fig. 29.1 Modelling competence as a continuum

In addition, whereas CTT and GT focus on the test level and the reliable assessment of individual differences on single constructs, IRT moves to the item level and can thus adjust parameter estimates for construct-irrelevant variance (Hambleton et al. 1991; Lord 1980). Although GT acknowledges the influence of construct-irrelevant variance on a score, no adjustments are made so that the final score still includes measurement error. Multidimensional IRT provides a major advantage here and adjusts for the influence of multiple sources of construct-irrelevant variation to provide error-free competence scores.

See, for example, the assessment of future and practising primary teachers' competence to manage science education classrooms (Gold et al. 2013). The teachers had to work on five videos that showed typical classroom situations which had to be rated on four-point Likert scales. The data revealed that the ratings of each video were strongly correlated. The authors decided therefore to allow for double loadings: each rating belonged to a general factor that represented the overall competence to manage classrooms and a second factor that represented the specific classroom situation to be managed. In some cases, the latter loadings were even higher than the loading on the general factor which questions the generalizability of classroom management across situations.

Furthermore, IRT allows for substituting the traditional unidimensionality paradigm by 'essential unidimensionality' (Gustafsson and Åberg-Bengtsson 2010) or multidimensionality (Reckase 2009). As pointed out at the beginning of this chapter, wide agreement exists that competence, on the one hand, is not a purely cognitive construct but includes affective-motivational dimensions (Weinert 2001). On the other hand, competence includes latent cognitive traits that are stable across many situations but also cognitive skills that are closer related to real-world performance and therefore less stable across different situations. Blömeke et al. (2015) summarized this inherent multidimensionality as displayed in Fig. 29.1.

Gustafsson and Åberg-Bengtsson (2010) proposed for such cases to focus on 'essential unidimensionality' which preserves the construct while allowing for addi-

tional minor dimensions and different sources of method variance. These models can be implemented, for example, with so-called bi-factor models or hierarchical second-order measurement models as it was done in the study of Gold et al. (2013) described above. Given that competence dimensions may be assumed to be multidimensional while at the same time a common underlying dimension is expected, this approach may be particularly useful in developing and understanding competence assessments (Blömeke et al. 2015). Multidimensional IRT provides a useful tool for modelling data from such assessments (Reckase 2009).

A final value added by IRT is the independency of parameter estimates from the specific assessment and the specific sample used. This provides the basis for criterion-referenced classifications which are of high importance in education. Item and test statistics estimated based on CTT depend on the specific items and persons selected, meaning that they are not invariant across different competence assessments or samples but have to be interpreted in a norm-referenced way as above or below the group's average. This can be demonstrated, firstly, by imagining an item intended to assess mathematics content knowledge that is administered to a strong group of mathematics teachers and to a weaker group. The parameter that indicates the difficulty of this item would be much lower in the first case than in the latter because, firstly, many strong mathematics teachers would be able to solve the item in contrast to the weaker teachers. Secondly, the problem can be demonstrated by imagining an item that is administered to a homogeneous group of mathematics teachers and to a heterogeneous group. The parameter that indicates how well items are able to discriminate between teachers would be much lower in the first case than in the latter because it is more difficult to discover differences in a homogeneous group than in a heterogeneous group (Hambleton and Jones 1993).

Criterion-referenced models based on item response theory go beyond such traditional norm-referenced approaches. They provide parameters that are independent from the specific sample of test takers and make it, thus, possible to define objective criteria of different competence levels represented by certain items. Such a level could be, for example, in the case of mathematics teachers' content knowledge, the ability to transform real-world problems into algebraic formulas on the level of high-school mathematics instead of only recalling or applying high-school mathematics formulas.

If a test taker can solve items of the first example, he or she demonstrates a higher competence level than in the two latter examples. From a teaching and learning perspective, such a criterion-referenced approach based on item response theory provides important feedback for a student, a teacher, a school or a country on what has been accomplished in relation to a specific objective, the criterion. The link between individual ability and item anchors the interpretation of a score in the items and not in rank order as CTT does. It is, thus, possible to draw subject-specific inferences from the test result, the diagnosis, and to adjust educational strategies so that learning is supported. This is meant by the term 'assessments for learning' that has become so popular (see the chapter of Van der Vleuten, Sluijsmans and Joosten-Ten

Brinke in this volume (Chap. 28)) but is seldomly applied to quantitative competence measurements (Gardner 2011). Also, the value added of IRT is rarely acknowledged in this context.

29.4 Conclusions

Way too long CTT/GT and IRT have been regarded as an allegedly incompatible dichotomy instead of looking at them as a continuum from linear CTT/GT models to nonlinear IRT models and beyond (Blömeke et al. 2015). The complexities of competence assessments, particularly in the fields of vocational and higher professional education, call for a merger of CTT/GT and IRT approaches. As pointed out, each theory has something to contribute to our understanding of the item functioning, scalability, reliability and validity of scores (Hambleton and Jones 1993). Of course, the different theories have been developed to solve different tasks, so one needs to be careful in selecting them to suit the particular problem at hand.

CTT has its strength on the test level, when it comes to the reliability of scores, and its models are based on only few assumptions. In contrast, IRT is useful for item-level analysis, examining dimensionality and typifying levels of performance to provide criterion-referenced interpretation. Because of its focus on the item level, IRT has moved forward the conceptual thinking about educational measurement because scaling results provide important information about the *nature* of a construct assessed (Rijmen et al. 2003).

The psychometric theories can and should be used in combination, too (Blömeke et al. 2015). For example, CTT and GT provide an initial step to disentangle the different sources of measurement error before latent variable modelling based on IRT takes place. To make use of the richness of these models and the respective values added in creating trustworthy competence measurements is strongly recommended to the community of researchers in vocational and higher professional education. The usefulness of combining GT and IRT has already been demonstrated (Raudenbush and Sampson 1999).

Still, at the very end, each researcher has to be reminded, no matter how sophisticated CTT, GT or IRT models are going to be applied; users have to remain aware that measurement models basically are always wrong in that sense that they are approximations to reality only as stated in the beginning of this chapter. It is possible to use these models to make inferences with high probability which are generally valid across larger groups of, e.g. teachers. A single teacher can always have a different competence profile, specific strengths or weaknesses though. On the individual level, we must therefore be very careful with too far reaching conclusions.

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Chapter 30
Quality Management of Competence-based Education

Antje Barabasch

30.1 Introduction

The concept of competence in relation to competence-based education as well as to measurable outcomes in outcome-based educational approaches is highly contested in the community of educational scholars (see, e.g. Alderson and Martin 2007; Frick 2014; Grabowski 2014; Salling-Olesen 2013; Vonken 2005). Both are innovation-driven concepts, often used synonymous although there are subtle differences. Much has been written and argued about the meaning of competence and if competence is teachable, accessible or measurable (see, e.g. Artelt et al. 2013; Bauer and Przygodda 2003; Fleischer et al. 2013; Weber and Achtenhagen 2014). The understanding of the term differs quite a bit among various scholars. In discussions on the alignment of vocational education and training systems across Europe, the term is widely used these days, although according to Mulder et al. (2007, 67) the 'lack of a coherent definition of the concept of competence, the lack of a one-to-one relationship between competence and performance, the misled notion that employing the concept of competence decreases the value of knowledge, the difficulties of designing competence-based educational principles at the curriculum and instruction levels, the underestimation of the organizational consequences of competence-based education, and the many problems in the field of competence assessment' is problematic. Wesselink et al. (2005) differentiate three traditions in competence research and call them the behaviourist, the generic and the cognitive approach. Above and beyond that other authors came up with their own classifications or competence frameworks (Ellström 1997; Mulder 2001; Weinert 2001). Mulder (2001, 2014) provided a general working definition of competence where the term

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describes the capability of a person to reach specific achievements, while Cedefop (2014) defines competence as the capability to use knowledge in practice. Both definitions complement each other.

Quality assurance in VET is a key priority within European policy. It is supported because VET qualifications need to become more transparent in order to ease mobility of workers between member states. The European quality assurance reference framework for VET (EQARF) provides recommendations to national and regional authorities. European countries started to cooperate within this priority in 2001 when the European forum on quality in VET was established jointly between the European Commission and Cedefop. Until the mid-2005, there was also a technical working group consisting of representatives of the two institutions and the member states, which was then replaced by the European Association for Quality Assurance (ENQA), the European policy learning platform for the exchange of experiences, consensus building and support for the common quality assurance framework for VET (CQAF) model in 2008 and 2009. The cooperative work has led to the definition of common principles, guidelines and tools for quality development. The concept of quality assurance comprises of four dimensions: quality of learning outcomes, assessment and validation, standards and competencies of the awarding institution. Quality assurance is also an essential part of many EU tools, such as the European qualifications framework (EQF) and the European credit transfer system in vocational education and training (ECVET). The EQF is a transnational meta-framework based on learning outcomes. It consists of an eight-level structure that has the objective of making qualification systems more transparent to employers, learners, qualifications authorities and education and training providers. It can be used as a tool that supports the translation between different qualification systems and their levels.

In the process of developing common criteria for quality, ten quality indicators have been proposed (European Commission 2008 in Cedefop 2009).

The ten quality indicators proposed[1] are:

1. Relevance of quality assurance systems for VET providers
2. Investment in training of teachers and trainers
3. Participation rate in VET programmes
4. Completion rate in VET programmes
5. Placement rate in jobs
6. Utilisation of acquired skills at the workplace
7. Unemployment rate
8. Prevalence of vulnerable groups
9. Mechanisms to identify training needs in the labour market
10. Schemes used to promote better access to VET

These indicators cover a wide range of aspects relevant for the delivery of VET. The majority of them refer to measurable outcomes at the national level. For

[1] Based on Annex 1 and Annex 2 of the proposal for a recommendation of the European Parliament and of the Council on the establishment of a European quality assurance reference framework for vocational education and training.

some, e.g. the utilisation of acquired skills at the workplace is partially addressed within European surveys. Cedefop has in cooperation with the European commission developed skills forecasting tools and statistics. At the national level, the amount of activities towards quality assurance differs widely and varies in emphasis. Some countries conduct yearly statistics on participation, completion and placement (e.g. Germany, Austria). Existing approaches include further (Ebbinghaus et al. 2008):

- Support of enterprise-based VET through chambers.
- Proximity between VET training among different enterprises and according to standards provided by chambers.
- Orientation of school education in VET at the praxis in enterprises.
- Shaping of framework condition of VET training (e.g. salaries) through enterprises in cooperation with unions.
- Monitoring of competence development through enterprises and schools.
- Apprentices or VET students are increasingly expected to take on responsibilities.

Over the past decade, there has been a paradigmatic shift in many European countries from a rather input-oriented approach towards the concept of learning outcomes. With awarding a qualification not only is the character and profile of specific learning communicated, it also signals the relative level and value of specific learning experiences and learning outcomes. In order to achieve transparency of qualifications, the outcomes of VET training need to be trusted, which is achieved through quality assurance within the assessment process (Cedefop 2009). Blömeke (Chap. 29) in this volume elaborates comprehensively on the various challenges to ensuring the quality of assessment in VET. These are naturally embedded within the multidimensional nature of education. In order to address them, the author proposes various approaches to competence testing and explains how they, when combined, ensure a high validity and reliability. However, Blömeke cautions that while conclusions from this research can be drawn towards group behaviour and results, at the individual level, competences can have very different characteristics.

Investing more in education might not necessarily lead to better outcomes in terms of educational achievements. Therefore, further investments in education need to be based on evidence that provides a rational for these decisions. In order to understand better if various forms of education lead to similar outcomes, these need to be measurable and ensure a high quality. Measuring the outcomes of vocational education therefore should not solely be based on achieving quantitative targets as indicators for effectiveness and efficiency of educational provision. Quality assessment needs to be based on multiple sources of evidence. Van der Vleuten, Sluijsmans and Joosten-Ten Brinke (Chap. 28) in this volume explain how portfolios provide evidence. It is secured through the provision of artefacts, recorded activities and other assessment documentation. Peer assessment can further ensure the validity of an assessment.

Policy makers across Europe increasingly pay attention to quality management within educational provision. For example, in many member states, accreditation of educational institutions is used as one among other governance tools to ensure the quality of training institutions and training programmes. Accreditation systems are

already in place in the Czech Republic, Greece, Italy, Luxembourg, Portugal, Romania, Scotland, Slovenia and Finland. In others, such as Cyprus, Estonia and Malta, an accreditation system is under construction (Cedefop 2011a).

Outcome orientation has often been driven by the development of national qualification frameworks and credit transfer arrangements, with the European qualifications framework (EQF) being a key driver in most countries. Cedefop closely monitors the introduction and further development of European instruments (EQF, ECVET), publishes programme reports and organises events for information exchange between member states.

Another driver for policy development towards outcome-based education has been the recognition or validation of non-formal and informal learning (such as Bulgaria, the Czech Republic, Denmark, Estonia, Finland, France, Hungary, Iceland, Malta, Norway, Portugal and the UK (Cedefop 2012). Especially in countries where many adults do not complete post-secondary or tertiary education but acquire extensive work experience, standardised procedures for the validation of knowledge and skills are particularly important (e.g. in Spain and Portugal). Other countries have already established practices in place, e.g. Bilan de Competence in France.

Common principles have been formulated at the EU level for quality assurance in higher education and VET in the context of the European qualifications framework according to Annex III of the EQF recommendation (European Parliament and Council of the European Union 2008 in Cedefop 2009). These include:

- Quality assurance should be an integral part of the internal management of education and training institutions.
- Quality assurance should include regular evaluation of institutions, their programmes or their quality assurance systems by external monitoring bodies or agencies.
- External monitoring bodies or agencies carrying out quality assurance should be subjected to regular review.
- Quality assurance should include context, input, process and output dimensions, while giving emphasis to outputs and learning outcomes.
- Quality assurance systems should include the following elements:
  - Clear and measurable objectives and standards
  - Guidelines for implementation, including stakeholder involvement
  - Appropriate resources
  - Consistent evaluation methods, associating self-assessment and external review
  - Feedback mechanisms and procedures for improvement
  - Widely accessible evaluation results
- Quality assurance initiatives at the international, national and regional level should be coordinated in order to ensure overview, coherence, synergy and system-wide analysis.

- Quality assurance should be a cooperative process across education and training levels and systems, involving all relevant stakeholders, within member states and across the community.
- Quality assurance orientations at the community level may provide reference points for evaluations and peer learning.

These guidelines provide an orientation for the implementation of policies at the national level. Many European countries have already developed approaches for quality management (QM) to meet specific national policy objectives. The term 'quality management' refers to a set of systems and frameworks which are in place within a VET organisation to manage the quality of outcomes and processes (Eurostat 2014). Quality management comprises all activities of management that determine quality policy, objectives and responsibilities and implement them by means of a quality plan, quality control and quality assurance within a quality system (ISO 1994 in Cedefop 2011b). Taking a systematic approach to quality assurance in respect to the content of programmes, curricula, assessment and validation of learning outcomes within competence-based education requires the following steps: planning, implementation, evaluation, reporting and quality improvement. Countries are at very different development stages, which is also a result of different VET traditions and existing skills formation systems. As a result the implications of these policies are debated at the country level within Europe, while at the same time, some of the European tools are already guiding reformation processes in VET outside of Europe.

More information on approaches to quality assurance can be found in the chapter by Blömeke (Chap. 29) in this volume.

30.2 Curriculum Design and Learning Outcomes

Based on the raising interest in competence-based education and outcome-based curricula, it is essential for this book chapter to clarify the main concepts here. Sometimes the terms 'learning outcome' and 'competence' are used interchangeably. Learning outcomes are validated by their relationship with competencies, which relates to practices in the workplace (or society) and to wider social and personal practices. Learning outcomes, nevertheless, do not directly refer to practices in the real world. They are instead validated by their connection to competencies, and they are given value (in the labour market). All outcome-oriented curriculum approaches establish a systematic way of identifying competencies and translating them into learning outcomes, but the language chosen for this translation varies across European countries (Cedefop 2012).

One way of ensuring similar quality standards in VET programmes across Europe is to focus on outcome-oriented curricula that incorporate key competencies and general knowledge and are used across a country within a particular occupational training. In this way equality within educational provision could be assured.

The policy of focusing on outcome-oriented curricula is linked 'to raising the status of initial vocational education and training (IVET) so that it is regarded as a positive choice rather than what people do if they fail to secure a place on a general/academic programme leading to university' (Cedefop 2012). Learning outcomes can have a social and political purpose through ensuring transparency within a VET system and in respect to qualifications. By introducing quality standards to the assessment of outcomes, a new approach to accountability is introduced as well.

Learning outcomes are a distinctive way of outlining what learners should gain from their learning programmes. This:

1. Implies a particular focus on what skills, knowledge and attributes a learner should acquire
2. Implies, at the very least, a rebalancing of emphasis from inputs to outputs in VET and, at the very most, the complete omission of normative descriptions of inputs
3. Makes a claim to validity, for example, that a set of learning outcomes are warranted because they correspond to a set of workplace performances or competencies (Cedefop 2012)

Research on the form and function of outcome-oriented curricula in general is growing, but to a smaller extent within the field of VET. A big debate within the research community circled around the meaning of competence and outcomes in education. Within Germany the concept of competence with its unique emphasis on occupational identity (Beruf) is well established, but it has had little influence outside the German-speaking nations (Brockmann and Winch 2011; Fischer 2013; Gehmlich 2009). A bit more influential has been the explicitly outcome-oriented system of initial vocational qualifications (NVQ) in the UK. It provided a model for other countries, both in Europe and beyond, albeit not always with great success (Allais 2012). Conceptual work has also been done in France during the 1990s which leads to reforms in education and training and eventually to a combination of the concepts of competence and learning outcomes (Cedefop 2012; Le Deist 2009).

The shift from a rather input orientation in curriculum design requires a number of changes at schools. Input orientation implies a strong emphasis on teachers' qualification and their ability to interpret the framework curricula according to individual, school, regional or societal needs. In the outcome orientation approach, the emphasis lies on common measurable competence acquisition. While traditionally curriculum design as much as school organisation focused on objectives, contents, disciplines, durations and activities (input), administrators, teachers and instructors would now be more concerned with measurable skills, knowledge and competencies. This ideological shift 'implies that outputs must be determined first; subsequently, the inputs may be selected which will serve to achieve those outcomes in the most efficient and equitable manner' (Cedefop 2012, 33–34).

The approach is not new to all European countries. Spain, for example, had competence-based approaches in place within adult and continuing training, but these were not explicitly introduced into initial vocational education and training (IVET). In other countries, such as Germany or France, competence-based IVET

curricula have been a reality for years now and are subject to innovation programmes and continue to be improved (Cedefop 2012). In the UK a skill-based model towards learning outcomes has been established which is strictly focusing on the fulfilment of very specific narrowly defined tasks, while in France it is a knowledge-based model based on the integration of theoretical and practical knowledge and incorporating aspects of personality development (Brockmann et al. 2008).

Until now, very few studies are available that indicate to what extent learning outcomes have been introduced into curricula in a meaningful way. The governance of IVET differs enormously across Europe and so does the responsibility for the design and renewal of curricula. Scepticism and a lack of knowledge about the implementation of the concept often prevent further efforts.

The assessment of learning outcomes (Cedefop 2009) can be pursued in various ways. First, they are used to:

1. Characterise (at the systemic level) overall aims for education and training.
2. Express the requirements or standards set by qualifications.
3. Clarify the intentions of curricula and learning programmes.

Furthermore, learning outcomes serve a variety of purposes:

1. To recognise prior learning
2. To award credit
3. To ensure quality
4. To improve credibility
5. To increase transparency (Cedefop 2009, 10)

More information on assessment of learning as well as assessment for learning can be found in the chapter by Van der Vleuten, Sluijsmans and Joosten-Ten Brinke in this volume.

Not only curricular design is essential when implementing a learning outcome approach. The quality of education also needs to be assured within the learning environment, which ideally supports learner-centred pedagogies. Learner-centred refers to a shift from transmissive instruction where information is transmitted by the teacher to learning as a process constructed by the student (Jonassen and Land 2012). The learning venues range from work-based learning, e.g. within an apprenticeship and alternation, to full-time vocational schools. The right balance between practical versus more theoretical instruction is another essential component, completed with the use of appropriate teaching materials (Cedefop 2012). When taking all these aspects together, it becomes clear that the shift towards outcome-oriented curricula and education means that the input orientation remains to be an essential part of it. On the base of these considerations, the challenge that teachers and schools are facing now is to find appropriate ways for the integration of the two approaches.

One way of delivering competence education can be in the form of modularisation of IVET programmes. The approach is discussed in a range of countries, e.g. Austria, Germany, Hungary, Latvia, Luxembourg, Portugal, Slovenia, Spain, Sweden and Turkey. According to Pilz (2009), different modular systems provide

students with varying degrees of freedom in their choice of modules. The approach centres at individuals' needs and preferences and is practised in Sweden, for example. The system enables students to gain credit for modules and transfer them between vocational and general education. In contrast, in highly structured education and training systems, such as those in Austria and Germany, modules are available only at certain stages of programmes and within certain tracks. Modularisation is up to now questioned as an approach that potentially undermines the occupational character of IVET (Cedefop 2012). The unitisation and credit accumulation might compartmentalise IVET; the occurring flexibilisation might be preferred by students who gain recognition for their achievements within a module. At the same time, the recognition of these modules at the labour market is not ensured. Employers might also tend to specialise units according to their needs and in this way compromise the overall transferability of an IVET certificate (Cedefop 2011a, b). In order to develop outcome-based curricula that are widely recognised among employers, it is essential to involve a greater number of diverse stakeholders and ensure that the curricula to be developed are not only addressing occupation-specific competencies but also learning outcomes associated with curriculum subjects, generic skills and other educational objectives (Cedefop 2012).

Overall, the approach to learning outcomes is still relatively new and highly debated. Many countries are currently transitioning towards outcome-based approaches, but little experience has been acquired yet. Also, where principles for training regulations are defined and instruments for learning standards are given, the description of learning outcomes in a way that standards for the competence acquisition can be derived is not developed accordingly. In Austria, for example, the apprenticeship training is based on a competence profile (specified in the training regulation) and based on learning outcomes. However, the competencies described are not translated into assessment standards. Austria and Germany also use a two-phase assessment within their apprenticeship programmes so that competencies are evaluated twice. Denmark has a competence-based approach within its VET system characterised by 'know, can and master' with an outcome orientation, but more is still in the development stage. A country in which learning outcome approaches have been implemented is Finland, where since the 1990s all qualifications are based on learning outcomes. They also form the basis of the certification process (Cedefop 2015).

30.3 Practices of Assessment in Competence-based Education

The award of qualifications in competence-based assessments requires comprehensive tasks that lead to skills demonstrations. Their approved completion serves as a criterion for the quality of a person's competence. Certifying competencies includes the processes of assessing, validating and recognising learning outcomes, which lead to a qualification and occupational titles. Occasionally the terms certification

and qualification are used interchangeably. The following definitions of assessment, validation and recognition of learning outcomes are used by the OECD (2005):

- Assessment: methods and processes used to establish the extent to which a learner has attained particular knowledge, skills and competence.
- Validation: the process of confirming that certain assessed learning outcomes achieved by a learner correspond to specific outcomes which may be required for a unit or a qualification.
- Recognition: for purposes of this study, the term recognition is understood in a narrow meaning as the process of attesting officially achieved learning outcomes through the awarding of units or qualifications. This term refers to formal recognition by the education and training system which results in the award of a qualification (through issue of a certificate or grade). In this study the term does not include recognition by the labour market or wider social recognition.

The introduction of national qualification frameworks in many countries is currently leading to the reform of various VET programmes which in the future have to be based on common qualification standards. Curricula and assessment standards will be designed accordingly.

Assessment can be distinguished according to (Cedefop 2009):

- Formative assessment: typically continuing assessment which aims at providing feedback and further informing the learning processes. Formative assessment may be used to enable learners to pass from one training phase to another (first year to second year), but does not result in certification.
- Summative assessment: this aims at formally determining that the required learning outcomes have been achieved and (when this is the case) result in certification.

More information on these two approaches towards assessment can be found in the chapter by Van der Vleuten, Sluijsmans and Joosten-Ten Brinke (Chap. 28) in this volume and Black (2000).

When it comes to assessing learning outcomes, overarching quality criteria apply, which are listed in Table 30.1.

Objectivity is one of the most common quality criteria, although operationalised in different ways. In Austria, for example, a trainer cannot be the examiner. In Spain this can be combined in one person, but an exchange between various examiners could increase objectivity. Hungary applies a praxis in which at least two examiners are always present, one representing the examination committee and one is an expert within the professional field. Validity is improved in many countries through an examination board that jointly develops the questions and tasks. Sometimes additional professional experts are included. Reliability mainly refers to keeping the assessment situation constant across populations of students. Other quality criteria include transparency and practicability. Transparency refers to documentation of assessment procedures and practicability to technicalities of the assessment which need to be in place across various institutions. The exact combination of means to achieve objectivity, reliability and validity varies, but always relies on two dimen-

Table 30.1 Quality criteria within assessments

Quality criteria	Application
Objectivity	Assessment/examination boards, certification committee (assessment is carried out or at least verified by more than one person)
	Students' own teachers or trainers are not assessors
	Students own teachers/trainers assess, but are not part of the decision-making examination committee
Validity	Exam questions developed by a pool of experts
	Assessment is monitored by inspectors
	Assessment is monitored by quality monitors
Reliability	Authentic context for assessment
	Assessment tasks developed together with representatives from the world of work
	Assessment aligned to performance criteria set in training standards
	Assessment tasks have to comply with the assessment scheme set by the awarding body that designs the qualification. An assessment task is checked through an internal process at VET provider level to ensure that it is compliant
	Assessment decisions are checked through an internal and external verification process
	Standards on who and how a certificate can be issued

Modified based on Cedefop (2015)

sions. There need to be binding guidelines in place with regard to assessment processes (e.g. who participates in an assessment, kind of assessment methods, assessment criteria), and assessment relies on trust and autonomy with regard to the competence and the experience of assessors (Cedefop 2009). The next chapter of Blömeke elaborates and discusses the criteria mentioned above in psychometric terms.

The European context shows that processes of assessing competencies vary widely and pose a number of challenges. Among them is the variety of governing institutions in VET (ministries, examination boards, VET providers, social partner, sectoral organisations, chambers, etc.) as well as the variety of actors and their role as awarding bodies (schools or employers). In addition the practical learning and the acquisition of practical competencies directly related to a real workplace, context and assessment can only capture part of these competencies, if it is at all aligned to real workplace situations. It is additionally complicated by the relativity in the assessment of performance.

In the German context the concept of 'Handlungskompetenz' is particularly relevant in the design of assessments. Assessments are defined on the basis of tripartite involvement and consensus reached between employers, trade unions and the state about occupational training standards. The German system does not conceptualise the occupational standard as being owned by employers and forming the foundation upon which the curriculum is built. Instead, the task of defining vocational education (Berufsausbildung) is shared between employers, unions, teachers and craft associations, and the 'Berufsbild' is produced as part of the collective process of

defining a qualification (Cedefop 2009). However, occupational standards have been introduced in countries that appear to share the 'Handlungskompetenz' concept (Austria and Luxembourg), which implies that cultures can change (Cedefop 2012).

There seem to exist about three broad models of quality assurance based on the continuum of divisions of responsibilities (Cedefop 2009):

- Prescriptive model: design of assessment criteria to specification of the exact methodology and content of the assessments is realised by one awarding authority.
- Cooperative model: decisions on the form and content of the assessments are left to individual providers.
- Self-regulated model: VET provider is also the awarder of the qualification certificates.

Usually it is not possible that only one model fits in one country because there is also variation within its borders. Therefore, the use of this categorisation is limited but provides an idea about the approaches.

Common principles concerning important elements of quality assurance (QA) systems (Cedefop 2009, 43) include:

- Clear and measurable objectives and standards
- Guidelines for implementation, including stakeholder involvement
- Appropriate resources
- Consistent evaluation methods, associating self-assessment and external review
- Feedback mechanisms and procedures for improvement
- Widely accessible evaluation results

The quality of assessments can generally be ensured through the provision of assessment standards and guidelines as well as monitoring systems at the macro level, the provision of a suitable infrastructure at the meso level, as well as training of assessors at the micro level. Learning outcomes represent a combination of theoretical and practical elements as well as a mixture between trade-/specialisation-/profession-related learning outcomes and more transversal learning outcomes (key competencies) which need to be assessed by a variety of methods. Among them are written exams, oral exams, practical examinations, on-the-job assessment or a combination of them.

Assessment methodologies vary across countries. Practical exams are widespread. While some countries (e.g. Germany) highly regulate the application of certain assessment methods, others provide a framework with general guiding principles. In the latter case, VET providers decide which methods shall be applied (e.g. the Netherlands). The possibilities for VET assessment are manifold and include skills demonstrations, simulations, portfolio, project presentations, fabrication of work pieces, role plays, theoretical and practical tests and standardised written tests (Cedefop 2009; Cedefop 2015).

The following list provides an overview of assessment practices in the countries (Cedefop 2015):

- Denmark: electronic tests with random test questions.
- Germany: chambers of industry and commerce develop exams, which often are applied across the country or broader regions.
- Austria: 'LAP-Clearingstelle' develops standardised assessments that are used across the country.
- Hungary: centrally organised written tests.

Several countries have developed quality indicators for VET providers which include quality assurance indicators for assessments. Estonia, for example, has implemented internal and external evaluation processes to assure quality. In Austria, the quality framework for VET quality initiative (QIBB) contains a field within the quality matrix, called 'Securing the quality and transparency of exams'. Several indicators for this quality field are provided and schools are expected to implement processes to meet the formulated requirements. In Romania, the National Quality Assurance Framework for IVET includes descriptors for assessment and certification. Hungary uses self-assessments conducted by students.

However, converting a learner's performance on an assessment to a clear indication of attainment (such as a grade or pass/fail) is not as simple as might be thought, as it may entail various other activities (Cedefop 2009, 16):

(a) QA of assessment: practices to ensure that the assessment is accurately and consistently applied across the range of awarding bodies delivering a qualification. Examples include centrally set assessments, standardisation meetings, assessment by multiple examiners/juries and internal and external moderation/verification.
(b) QA of validation: practices designed to ensure that the evidence from the assessment is accurately and consistently judged against a predefined standard. Examples include boundary setting, benchmarking, direct grading by individuals or juries and the use of grading descriptors and grading grids.
(c) QA of recognition: practices to ensure that those responsible for recognising qualifications on the basis of assessment and validation are competent to do so.

This section provided a comprehensive overview about quality assurance in VET assessments. There are different terms used for assessments, sometimes interchangeably, but in order to determine what kind of quality assurance should be approached, their clarification matters. There exist a variety of forms of assessment and approaches to assessment. Their application varies between VET programmes and countries.

30.4 European Quality Assurance in Vocational Education and Training

Implementing the learning outcome approach involves significant changes in the design of curricula because learning outcomes are validated by their relationship with competencies. This means it needs to be tested to what extent the student masters practices in the workplace. The relationship between learning outcomes and competencies is a critical one. To what extent this relationship has been achieved in institutional arrangements and procedures will be described at the example of various countries in this section (Cedefop 2012).

The approach towards competence-based education based on a common outcome orientation varies widely across the EU. In some countries learning outcomes are relatively holistic and embedded in framework curricula. The expectation towards teaching and assessment is provided through the specification of knowledge outcomes, e.g. in France, or the specification of key competencies, e.g. in the Netherlands. In Iceland and Ireland, there is an explicit intention to restrict the degree of prescription at the level of the national standard to leave room for specification at the local level. Similar developments are observed in the UK. A highly regulative outcome-oriented curriculum is sometimes associated with a relatively unregulated competitive VET market. Instead of heavily regulating the quality of providers, the state ensures the quality of VET by specifying in the curriculum which learning outcomes will be assessed (Cedefop 2012).

When an outcome-oriented curriculum is highly regulated, it responds to a relative unregulated and diverse market of VET provision. In this case less emphasis is put on quality assurance at the input level, but by specifying which learning outcomes will be assessed. Praxis across Europe varies. In France, for example, a relatively prescriptive curriculum combines holistic vocational outcomes with demanding knowledge requirements. In the case of the UK, learning outcomes are relatively granular, while the Netherlands have a complex set of requirements regarding key competencies (Cedefop 2012).

The credibility of qualifications is not only achieved through an emphasis on input or output. Building a reputation within VET providers, e.g. through a high transition rate into the labour market or the recognition of skill levels achieved within institutions by employers, is a quality measure in itself, e.g. in Hungary and Norway (Cedefop 2012). Other countries do not have national measures for quality assurance at the enterprise level in place, e.g. Slovenia (Cedefop 2012).

Overall it can be concluded that a cooperation of various stakeholders, including employer and employee representation, in working groups on curriculum design or in the form of consultation ensures the acceptance of learning outcomes at the employers' level. In the case studies, examples of strong representation were found, for instance, in Austria, France, Germany and Spain. Experts play a crucial role in informing the development of written outcome-oriented curricula and qualifications, in operating the complex procedures and in working with stakeholders to reconcile differences and solve problems. Quality assurance does not need to be in

the authority of the state. Other bodies, such as chambers of industry and commerce, can also play the leading role in this respect (Cedefop 2012).

In terms of the accreditation of VET providers, the main function of the accreditation systems is to assure that minimum standards in delivery of VET are respected. They rarely push forward dynamics towards continuous improvement of training quality in VET provider organisations. It is difficult to combine these two functions: respect of minimum standards and continuous improvement of training quality. Most accreditation systems focus on certifying what is in place and pay little attention to improvement. Therefore there is room for enlarging their scope to include an improvement function (Cedefop 2011a). Overall, national responses to quality assurance of certification are diverse and reflect different traditions and philosophies of coordination and governance of education and training systems.

30.5 Conclusions

This chapter proposes that more attention has to be paid to quality assurance in competence-based education with a particular emphasis on certification processes. The shift towards outcome-based approaches in education is still relatively new, considering that it has not been fully implemented in most European countries. Most of the research done in the past focused on quality assurance at the input side, such as the content and delivery of teaching, teacher and trainer qualification, governance and administrative arrangements as well as internal/external communication. While this focus is still highly relevant, the continuing political shift towards learning outcomes at the national and European level requires a stronger focus on assessment and certification. In this light research on different forms of VET assessments (Rauner and Haasler 2009; Rauner and Heinemann 2009; 2011; Winther 2010) provides approaches towards quality assurance. New arising questions in this respect are if computer-based standardised approaches of assessment (see the chapter of Blömeke (Chap. 29) in this volume) based on practice-based units are sufficiently signalling the acquisition of VET competencies or if new approaches towards the training and certification of assessors need to be taken in order to ensure that they are judging performance in practical exams according to common standards. The arising debate on learning outcomes and quality has certainly provided VET researchers with a new push towards empirical research and evidence building.

The learning outcome approach implies that there is no single route to a qualification; learning may take place in different ways, in formal and non-formal and informal settings. This requires high-quality assessment, validation and recognition approaches able to guarantee that individuals meet the expectations set by the standards in question. Quality assurance must, therefore, address both the input and the outcome side, teaching and training and assessment, validation and recognition. Based on the large discrepancy in approaches employed by European countries, it

seems too early to arrive at common assessment practices. The biannual world skills competition (see the chapter of Nokelainen et al. (Chap. 36) in this volume) is certainly a playful way to compare outcomes of VET education with the addition of a peaceful competition between teams from around the world.

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Chapter 31
Competence-based Education and Educational Effectiveness

Lorenz Lassnigg

31.1 Introduction

This chapter relates two complex concepts and discourses to each other, 'competence-based education' (CBE) and 'educational effectiveness' (EE). Superficially, this relationship seems quite simple and straightforward, if we take some 'hegemonic discourses' that try to impose certain specified understandings of these concepts. Then it means something like competence-based education implies a shift of attention in education policymaking from inputs to outcomes, with the purpose to increase the effectiveness of education. This chapter critically assesses the available research evidence that underpins this normative expression.

First, CBE denotes a quite broad family of policy and practice proposals with diverse and sometimes shifting ingredients, rather than a sufficiently clear specification of a policy that can be implemented and evaluated (see the chapters in part II on CBE as a global innovation). Moreover, despite the scientific ideal of knowledge accumulation, the concept has become more diverse since its introduction in the USA in the 1970s.

Second, a review of the academic and professional literature shows astonishing few attempts to analyse the effectiveness of CBE; it seems that the rhetoric of evidence-based policy and practice has refrained itself from looking at the outcomes of CBE; thus, this educational philosophy might represent a kind of magic stick that would automatically bring about the desired results.

This chapter is based on an extensive search and review of literature of two kinds: (1) academic publications from *EBSCOHOST Education Research Complete* and (2) mixed user-led practical, political and scholarly material from *Google* and *Google Scholar*. The searches were not only restricted to 'competence-based

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education and training' but used also the expressions 'competency' and 'outcome' instead of competence and 'learning' instead of education and training (Tables A.1, A.2 and Figs. A.1, A.2, A.3 and A.4 in the annex provide an overview about the searches). Using these different terms resulted in some overlaps in the search results but also displayed different bodies of literature.

In this chapter, 'CBE' is used as a general concept, subsuming the different expressions (competence, competency, outcomes as well as education, training and learning). The different listings of results are available from the author. The focus of the searches was on effectiveness; however, next to that a good overview of the more basic and general literature also emerged.

The searches provide some basic patterns of the discourses around CBE. First, the Google search identifies mainly other kinds of documents than the search in the research material, including few popular items from research also, mainly from the 1990s; many practical and political documents and web items are also available via Google, with slight concentrations in medicine, the USA and higher education. Second, the different expressions are used in parallel, with different degrees of popularity; e.g. the expressions of outcome and learning are more popular than competence/competency and education/training; education is more popular than training, and competence more popular than competency; however, in research, 'competency' is more popular (only for simplification throughout this chapter the term competency is used). Third, the incidence of publications shows an exponential increase, with a 'takeoff' since the 1990s, and a slight increase of tackling with effectiveness or effects from about 10 % of hits in the 1970s to about 30 % of hits currently. Fourth, four distinct time periods can be identified with stepwise increases of the publication activity: (1) 1970–1994, (2) 1995–2004, (3) 2005–2010 and (4) 2011–2015. Since the 2000s, the representation of 'effect' shows a kind of cyclical pattern, with sharp increases in 2001, 2005, 2011 followed by some years of decline. Overall about 16 % of hits give some emphasis to issues of effectiveness, with an increase to almost 40 % in the 2011–2014 period. A closer inspection will show many meanings of effectiveness and only few items that really tackle the effectiveness of CBE.

A control search was also run the other way round, about 'educational effectiveness' in publication titles and the various CBE expressions in text, which indicated basically different discourses about effectiveness and CBE. The inspection of the abstracts gave not even one article that analyses the effectiveness of CBE in a more general sense.

31.2 The Complexities of Competence-based Education and the Emergence of the Concept at Political and Research Levels

In order to understand the meaning of competence-based education, two different aspects are important: first to state positively what is understood by this concept and second to find alternative and competing concepts of education and training to CBE.

Morcke et al. (2013, 860) in their historical overview trace CBE (in their terms OBE) back to the 1950s in the USA, and during a 50-year period, they find 'two clear cycles of advocacy and then critique'. The second cycle started more or less on the conceptual fundaments of the first cycle in the 1980s. Competence-based education was coined as a general concept, based on the ideas of mastery learning and criterion-referenced testing. The idea was that learning, teaching and organisation should be guided by clearly specified (minimum) competencies which would have to be demonstrably acquired (for a stylised distinction of CBE and 'traditional' approaches, see Table 31.1). CBE was thus devised as a programme for fundamental reform of education. Some current observers draw a distinction between these 'old' approaches, which have to some extent lost interest during the 1980s, and were embedded in a more general withering of expectations in policy-driven systemic reforms and the rise of economically driven neoliberal programmes of 'high stakes' and 'new public management'.

Nevertheless, catchwords of these times still sound very familiar today: CBE should 'eradicate the notion of failure', address students as 'focal point' instead of teachers, give students 'as much time as needed to learn' and 'always the opportunity to certify', bringing formative assessment to the fore; teachers should 'manage learning' instead of 'dispensing information', and schools should be transformed into 'learning centres'. However, very early on already, some heavy cleavages at theoretical, political and practical dimensions emerged, which are prominent in current disputes around CBE. Tyo (1979, p.426) mentions some key issues:

Table 31.1 Conceptual oppositions due to the 'old' CBE-conceptions

'Traditional' approaches	CBE approach
'Seat time'	Credentials based on 'observable activities demonstrated'
'Standardised testing' (national comparison among students)	Assessment by 'criterion referencing'
'Segmented behavioural' curriculum	'Balanced curriculum', based on selection of small number of key 'major objectives' (medium-level specificity, in between 'mushy' standardised tests and 'too exact' behavioural objectives)
'Slippery' measurement, 'student against student'	Measurement 'explicit', 'mastery of skills' (national-local)
Fixed progression time	Flexible time structure, 'as much time as needed to learn', 'always opportunity to certify'
Group-based instruction	Units, modules
Dispensing information	Teacher managing learning
Teacher at the centre	Student 'focal point'
School	Learning centres (+evaluation centre)
Achievement of other students	Grouping based on mastery of subjects
Testing only for certification in the end	Testing throughout the course, identifying gaps for decision-making

Sources: Review Tyo (1979), based on Benoist (1975), Harrison and Nagel (1974), Schmeider (1975), Spady (1977), Spady and Mitchell (1977), Turney et al. (1974), and others

- First, against the strong stance for 'criterion referencing' in CBE, he observed a strong 'proclivity towards becoming normed' in practice and policy, which has clearly materialised since then.
- Second, he addresses the top-down bottom-up polarity and positions CBE rather in the top-down pole, with two basic approaches being prevalent, one from top-down called 'accountability' that 'purports to stop incompetents from surviving in the system' and the other named 'reform' ('In this version, the movement of authority is reversed […] A basic faith in the judgement of the learner is assumed…'; ibid., p.426).
- Finally, with reference to Spady (1977) and the 1970s Portland Project, the problems of goal setting and measurement are addressed, with a strong emphasis on the selection of goals and objectives at the local and practical level. '…CBE entails a reconsideration of goals … the mechanisms for reaching the goals must also be re-evaluated … goals originate from the instructors themselves … the movement of goals is from the bottom up instead of from the top down' (ibid, p.425). The problems of assessment should be solved by finding a kind of middle way between 'too mushy' standardised tests and 'too exact' behavioural objectives ignored by the profession.

A 'new' wave of reception of CBE started in the 1990s at the level of the European Union, following first strong moves in the UK. This second wave focuses strongly on the idea of 'Qualification Frameworks (QF)', which specify the desired outputs or outcomes of education and training. One expression is learning outcomes, and others are the different variants of competencies (see Chap. 1 in this volume). Thus, the definition of competencies has prominently come to the fore, with different and partly opposing ideas of how the specified outcomes relate to education, training and learning processes in practice.

In fact the assumed consequences of the definition of competencies to the practices in the system are ranging from some kind of 'automatic' drivers towards change implied in the formulation of the outcomes at one pole (seminal Bjørnåvold and Coles 2007/2008) through insisting on a high degree of contingency between outcomes and practices (Biemans et al. 2004; Mulder et al. 2007) at the other pole, to a denial of direct positive consequences for the practice level (Allais 2010, 2014 calling the National Qualifications Framework a 'castle in the cyberspace').

The competing theoretical conceptions of CBE seem to have changed since the beginnings, when norm-referenced testing was the main competing approach, and the current discourses, with broader approaches of 'reflective learning' in the field of professional learning being seen as main alternatives to the outcome-focused CBE (see, e.g. Chow et al. 2011 and the work by Michael Eraut, and work building on the thoughts of Donald Schön). This pattern points at the ambiguities in the approach, as the focus on measurable outcomes due to the standards movement does not contradict norm-referenced standardised testing any more in today's conceptions. Some observers see the main practice of implementation of CBE as simply attaching outcomes for assessment to the ongoing traditional practices, whereas the basic logic is neglected, that 'CBET demands a reverse educational process',

in which the objectives should guide the curriculum, teaching and assessment (Vitali 2011, 237).

We can find different discursive strategies to establish CBE. On one pole, CBE is constructed as a 'new promising approach' progressively adopted worldwide, contrasting to 'traditional' ones, giving definitions of the main concepts and providing recipes of how to implement the approach (see as recent example GIZ 2013). On the other pole, authors try to relate the conception to the broader body of established theories and discourses in the scientific field. Mulder et al. (2007) have situated CBE in a broad multidimensional field of meanings of competence that cannot be reduced to a single dimension (Table 31.2). Given the diversity of actual and potentially reasonable configurations of the characteristics at the nine dimensions, the authors deny the possibility of a reduction of the meaning of competence to a single common and somehow 'right' conception; they plea instead for a pragmatic and contextualised use of the concept, as '[…] it can be concluded that the concept of competence is multidimensional, and specific use of the concept depends on the context of the users' (ibid., p.73). This consequentially would mean for the implementation of CBE that there cannot be a single policy or practice but rather a broader family of policies and practices; furthermore, it would follow for the evaluation of effectiveness that no simple results can be expected from this broad variety of configurations.

A main observation in the seminal work edited by Burke (1989/2005) was that CBET was widely neglected by the research community around the 2000s and was taken up mainly as a political and practical endeavour. Kerka (1998), following Jackson (1994), has proposed to see CBET as a policy approach, explicitly contrasting this to 'a teaching-learning process' or 'an educational method'. Ecclestone (1999) describes the discursive strategies and patterns in the UK that have driven apart the advocates on the one side and the 'critiques' or 'ignorants' on the other, which have created sterile fights instead of searching for evidence (similar or even more pronounced hostile discourses can also be found in Australia till the 2000s; e.g. Berlach and McNaught 2007).

Table 31.2 Stylised dimensions in a multidimensional field of 'new' meanings of competence

Narrow, decontextualised, functionally performance oriented conceptions	Broad, systemic and situated capability-oriented conceptions
Peripheral ability (as competence)	Versus core ability (as core competence)
Contextual dissoluteness	Versus situational attachment of competence
Orientation of competence towards functions	Versus roles
Representation of competence in terms of knowledge	Versus ability
Focus of competence on behaviour	Versus capability
Person	Versus system as a carrier of competence
Scope of competence as specific	Versus general
Learnability	Versus unchangeability of competence
Performance orientation	Versus development orientation of competence

Source: Mulder et al. (2007)

Table 31.3 Examples of professional and micropolitical networking activities towards CBE in the USA

+ The 'Competency-based Education Network', a group of colleges and universities in the USA [http://www.cbenetwork.org/competency-based-education/]
+ 'Educause', an organisation that works in the IT-sector and provides resources for the development and implementation of CBE [http://www.educause.edu/events/breakthrough-models-incubator]
+ The Council for Adult and Experiential Learning (CAEL) [http://www.cael.org/what-we-do/competency-based-education]
+ 'Educational Research Associates', a critical and antagonising organisation/network towards CBE that runs webpages and publishing services as 'ERALearning' [http://www.eralearning.com/01/edpolicy.php]
+ Halcyon House [http://www.halcyon.org/index.html], also a critical organisation situated in Oregon

Source: Own compilation

The discussion of the complexities of CBE has shown a long tradition of discourses about the basic ideas and conceptions. In the USA, a long tradition of CBE exists since the 1970s that has started as a kind of 'progressive' top-down political endeavour, mainly in the public school system (see the Chap. 12 in this volume). In the meantime, however, top-down policies have become discredited, and CBE policy has gradually shifted towards activities in the non-governmental sector, with a quite strong concentration in higher education. Particularly the Google searches display many professional and micropolitical networking activities at the level of institutions and supporting foundations and non-profit organisations (see Table 31.3). US politics towards the school sector has shifted to more traditional patterns of standardisation and high-stake practices combined with economic incentives and new public management strategies, practices which were originally rather antagonised by the CBE movement.

In Europe, CBE was first taken up in the 1980s in the English vocational education sector and subsequently adopted by the European Union, trying to persuade the member states to shift to CBE policies in the overall education system (CEDEFOP 2009). The EU core rhetoric is strikingly similar to the original US arguments against 'traditional' educational methods. Interestingly, the US experience (1970–1990) was not systematically assessed before the import of the political rhetoric in Europe or other regions in the world. South Africa, where CBE policies were at first enthusiastically taken up as instruments for reform after the fall of Apartheid, was rather discarded later (Muller 2000; Allais 2014); Australia as well as Hong Kong (universities, 2005) and Malaysia (schooling, 2008) can be seen somehow as mediating regions in this respect. CBE issues in the UK and South Africa have much attention in the research literature.

Another strand of policies and practices concerns a set of professional or occupational fields: CBE policy and practice is by far most established in medicine and health services, mostly under the name of outcome-based education and training (OBET); other strongly discussed and analysed fields in policy and practice are IT

and technology/engineering; the research literature is also to some extent concentrated in social work, and teaching is a focal theme in policy/practice as well as in research.

Different aspects of CBE are emphasised in the contributions dealing with education systems or sectors as compared to those about professions or occupations. Whereas the former tend to conceptually discuss and/or explain more basic issues of CBE (what it might mean, who supports or objects it and why, and what the pros and cons of this practices might be), the latter tackle much more technical issues and often provide also empirical studies of some scale (Lassnigg (2015) documents and reviews more deeply the development of CBE at the level of policymaking).

Summarising the emergence of the CBE artefact, two paths of its 'travelling' can be found in the course of the last three or more decades, one through different regions and countries and one from the political and educational system or sector level towards smaller more homogenous professional or occupational fields and to non-governmental actors in the civil society. The regional travelling might indicate a kind of 'political life cycle' of the artefact, at least at the level of the formal state and public political system: it was taken up, grew and subsequently declined and was taken up at other places with a high degree of initial attraction, which develops and declines again, etc. So it has travelled from the USA to the UK, and other regions (Australia, New Zealand, South Africa), and even later to the European Union. As an example for the travelling of CBE, Chisholm (2007, abstract) points out that '[…] South Africans have tried to export the idea at the very moment when evidence is revealing little relationship between policy intention and outcome, it is contested at home, and there is a retreat from it in some sectors of education'. While the artefact travelled from the political level to practical endeavours and networks, the EU took up CBE at the political level and sent it to the member states (similarly, a worldwide travelling is going on despite much critical evidence particularly in regions and countries outside the rich OECD world; Allais 2010). The question arises, why this influential artefact has not provoked more research about its outcomes so far.

The travelling from the political to the professional and occupational level shows different patterns in different fields. In teacher education, it is strongly related to the broader discourses of education policy, whereas in medicine and the health services (parts of), the profession has taken up the artefact as a part of the improvement of professional education. In the latter field, the discourses are less driven by general arguments of pros and cons than by technical considerations of how competencies might be cooperatively and consensually defined, and how they might subsequently be translated into curricula, learning and assessment (see the material provided by the Association for Medical Education in Europe (AMEE; http://www.amee.org/home), which meanwhile has a worldwide outreach, e.g. the AMEE Guides No.1–93 or the Best Evidence Medical Education (BEME) Guides No.1–30, several of which are dealing with aspects of CBE. This forerunning experience might be explained by some specific characteristics of the medical profession, first its well-established tradition and autonomy and second its strong drive towards evidence-based practice. It might be contended that the construct might be easier applied to a well-established

field with a relatively clear structure and marked borders than in a field which is new and dynamically evolving, without structures and borders of a similar kind.

31.3 Educational Effectiveness of Competence-based Education and Training

In the discourses about how research can and should be used in policy and practice, Cook and Gorard (2007) have proposed a model of the research cycle that distinguishes different stages and phases including a first descriptive sub-cycle starting with the review of existing evidence, constructing interventions ('artefacts') tried out by feasibility studies and ending with an elaborate 'prototype' of the policy. In a second causal-analytic sub-cycle, the prototypes should be subjected to definitive (ideally experimental) testing, before they are disseminated more widely. Concerning the effectiveness of CBE, we can use this conceptualisation for the review of existing research about the different varieties of CBE.

As described above, in the discussions on the complexities of CBE, a long tradition of discourses about the basic ideas and conceptions has turned out.

The 'travelling' of the CBE artefact at the level of policymaking has given hints about a gap between the promises and expectations in the increase of effectiveness by CBE on the one hand and a kind of magic belief into the realisation of these promises on the other. This section will go deeper into this issue by presenting and discussing the results of the literature review.

Before that, we can draw some preliminary conclusions from the above reasoning about the complex concepts and the de facto input-oriented politics of seemingly outcome-oriented CBE. Taking the model of the research cycle presented above, we have seen that explicitly policy-related research has mostly not gone further than to construct and discuss the artefact of CBE and to some extent working on prototypes and analysing their implementation. The answer on the question as to why endeavours of definitive testing, despite the long period the artefact is already existing, are not popping up at first sight can be found in the complex nature of the artefact which arise from two different aspects, first the width and diversity of the artefact (a 'holistic' new practice) and second the comprehensiveness of the concept that claims to provide a new education and learning model opposed to the traditional one (i.e. learning centres instead of schools, facilitating instead of teaching, etc.). Definitive testing inevitably presupposes a counterfact, meaning that results of CBE must be systematically compared to a situation 'without CBE', e.g. teaching and learning along an alternative model or artefact. As long as CBE cannot be clearly demarcated against alternative models, definitive testing is simply not possible.

CBE and Effectiveness Research A first result about research-based knowledge of effects of CBE can be found by searching contributions about educational effective-

ness (given by title) that include expressions about CBE in different versions. This search was restricted to the expression of 'educational effectiveness' in titles, because otherwise it would have been meaningless as the words occur too frequently by chance; the documentation of the search is available from the author. This search found 166 hits; however, the inspection of the contributions found showed clearly that the effectiveness discourse is disjunctive from the CBE discourses: at closer inspection, none of the contributions found did really refer to conceptions of CBE. The expressions included in the searches (competence/competency, outcome, education, training, learning) were found very scarcely (competence/competency only 3 times totally), or appeared in other, coincidental combinations in the texts. A closer inspection of the searches 'educational effectiveness' in title and 'competence-based education/training' in text did not find any contributions that clearly refer to CBE approaches; for illustration the items of this search that identified 'competence' and/or 'outcome' in abstract and/or title are displayed in Table A.3 in the annex.

Most contributions found concern school effectiveness research according to the various models developed in this realm (Reynolds et al. 2014; Creemers and Kyriakides 2010, 2013); some further contributions deal with the economic aspects of effectiveness (e.g. Levin 1988, 1998); mostly the school sector is addressed. The main approach of analysing effectiveness is identifying factors and dimensions influencing test results by sophisticated quantitative models, trying to identify patterns of those factors and their embeddedness in situations or context. These models differ fundamentally from CBE, as they are analytic in the sense that they try to identify patterns of factors, whereas the CBE approaches start with synthetic conceptions of kinds of holistic practices that presuppose already certain patterns of variables (structure of curriculum, facilitating practices by instructors, criterion-based assessment, etc.).

Overview About Effectiveness in CBE Research To identify a manageable body of literature, a set of additional searches was finally conducted that have combined versions of CBE and effectiveness. Three searches were run using the expression 'competence': (A) 'competence-based education/training' in TITLE and 'effective' in TEXT (including ABSTRACT) results documented in Table A.4a in the annex, (B) 'educational effectiveness' in TITLE and 'competence-based education' in TEXT and (C) 'educational effectiveness' in TITLE and 'competence-based training' in TEXT. The 'effective' searches B and C did not find references to CBE (see above); in addition searches were run using 'competency' and 'outcome'. These expressions are more widely used, and searches could be restricted to TITLE and ABSTRACT: (A) 'competency-based education/training' TITLE and 'effect' ABSTRACT and (B) 'outcome-based education or training' TITLE and 'effect' ABSTRACT, results are documented in Table A.4b in the annex.

From overall 68 valid contributions found, about half (32) were identified that are dealing with issues of effectiveness of different versions of CBE in various areas of education and training; another half include the term 'effect', but deal in fact with other topics (Table 31.4). Figure 31.1 shows a combined time-regional pattern of the contributions, with very few items published before the end of the 1990s, and all

Table 31.4 Overview of searches about effectiveness

	'Competence'	'Competency'	'Outcome'	Total
Total items CBE and effect	56	15	27	98
Dealing with CBE effectiveness	15	10	8	33[a]
Dealing with CBE not effectiveness	29	2	-	31
[Reviews; not considered]	3	1	-	4
Valid contributions dealing with CBE	47	13	8	68
Not dealing with CBE	9	2	19	30

[a]Three contributions were found more than once in different searches, so the 'net' number of contributions dealing with effectiveness is 30 contributions
Source: Searches in EBSCOHOST Jan 2015 [http://www.equi.at/dateien/cbe.pdf]; Searches in EBSCOHOST Jan 2015 [http://www.equi.at/dateien/cybet-obet.pdf]

early publications being from/about the USA; after that we find a time pattern starting with the UK (and South Africa) at the turn of the 1990s–2000s, followed by Australia during the 2000s and by the Netherlands after 2010 (only few mostly single publications include other regions/countries, mostly after 2010: Iran, Lithuania, Hungary, Slovenia, Ghana, Taiwan). The occupational/professional groups reflect more or less the country patterns. So we see here also a travelling of the publication activity through time, as in the policy field.

The items not dealing with effectiveness were distinguished according different aspects of development/delivery of CBE, from the construction/definition of competencies/outcomes, through implementation to assessment, including also a category of general items dealing with issues of concepts/theory/overview (CTO) of CBE. Here we cannot find any logical structure (which could make sense, e.g. starting with the definition, going to implementation and finally to assessment). These contributions concentrate a bit later in time than the effectiveness contributions, and there is some concentration on assessment in the 2000s, and most contributions deal with CTO from mid-2000s to mid-2010s. This structure would indicate rather a recent revival of basic discussions about CBE than kinds of systematic collective development and knowledge production.

Conceptions of Effectiveness The contributions include many different aspects and versions of effectiveness, and mostly there is not much conceptual clarification of what effectiveness might mean. As an exception, the contributions in the field of health/medicine make use of the modified Kirkpatrick Model of educational outcomes distinguishing six levels of outcomes. The Kirkpatrick Model (Fig. 31.2) was developed in the 1950s and is a categorisation of levels of training outcomes which was and still is quite popular in the private training sector. This classification seems useful for providing an overview about the aspects of effectiveness covered by the selected contributions. We see a quite even distribution of contributions that analyse, mostly empirically, the reactions of students on CBE practices (level 1) through

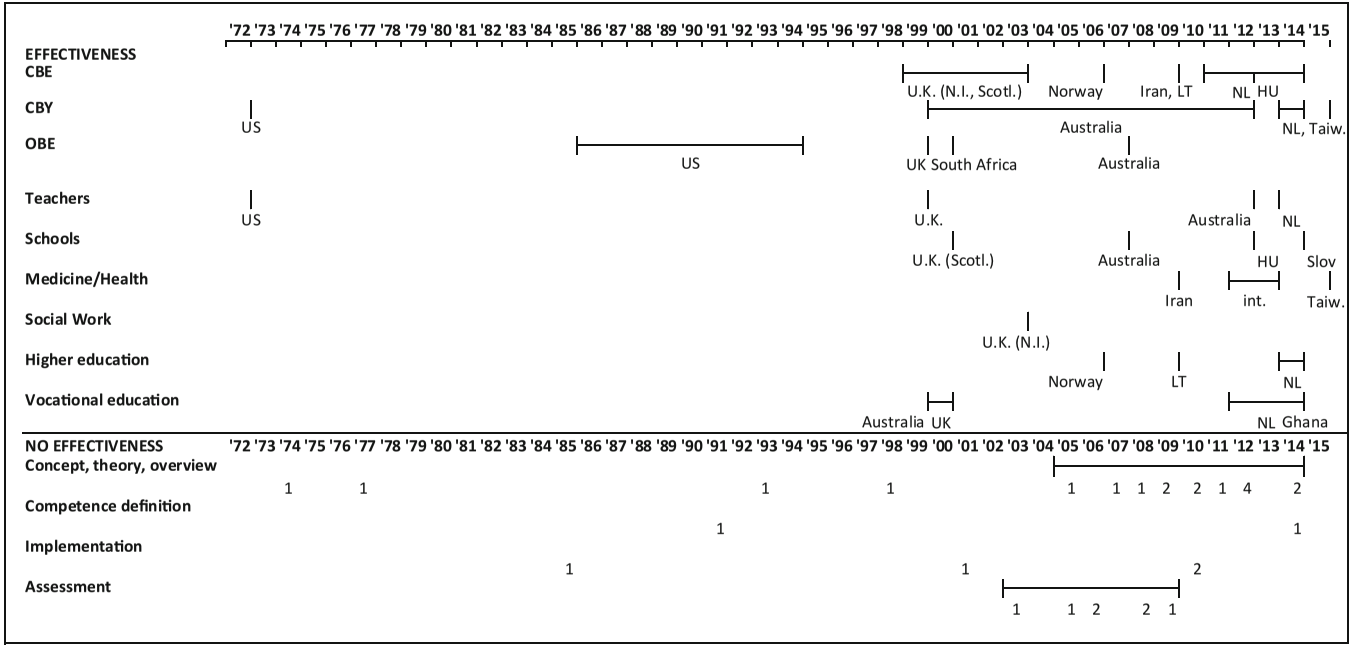

Fig. 31.1 Finally selected items containing expressions related to effect by region/country, topic and time published (Source: Searches in EBSCOHOST Jan 2015 [http://www.equi.at/dateien/cbe.pdf]; Searches in EBSCOHOST Jan 2015 [http://www.equi.at/dateien/cybet-obet.pdf])

			Proportion of identified contributions*
Level 1	REACTION	Participants' views on the learning experience, its organization, presentation, content, teaching methods, and quality of instruction	9 (30%)
Level 2A	LEARNING change in attitudes	Changes in the attitudes or perceptions among participant groups towards teaching and learning	6 (20%)
Level 2B	LEARNING modification of knowledge or skills	For *knowledge*, this relates to the acquisition of concepts, procedures and principles; for *skills*, this relates to the acquisition of thinking/problem-solving, psychomotor and social skills	8 (27%)
Level 3	BEHAVIOR change in behaviors	Documents the transfer of learning to the workplace or willingness of learners to apply new knowledge & skills	6 (20%)
Level 4A	RESULTS change in the system / organizational practice	Refers to wider changes in the organization, attributable to the educational program	8 (27%)
Level 4B	RESULTS Change among the participants' students, residents or colleagues	Refers to improvement in student or resident learning/performance as a direct result of the educational intervention	8 (27%)

* From the 'net' number of 30 contributions some were ordered to more than one level (average 1.4 ratings per contribution), and few could not be ordered to a level because of their more general or multiple argument; most of the more general contributions were rated in the level 4 categories.
Source: Steinert et al. 2006, based on Freeth et al. 2003 and Kirkpatrick Partners [http://www.kirkpatrickpartners.com/OurPhilosophy/TheKirkpatrickModel/tabid/302/Default.aspx]

Fig. 31.2 Model of educational outcomes, by Kirkpatrick, Freeth et al. (2002) and Steinert et al. (2006)

the analysis of effects on the development of learning knowledge, skills or attitudes (level 2) and less so on behaviours (level 3) to more broad and mostly narrative analyses of effects on schools, teachers and/or broader systems (level 4); very few empirical analyses are dealing with this level.

Methodology and Scale of the Contributions Almost all contributions include some kind of empirical data gathering and analysis, mostly of quantitative methodology; a few refer to case studies or literature-based reasoning. We can identify three broad types of methodological designs using empirical data: (1) experimental or quasi-experimental designs that compare in a controlled way some kind of CBE with different approaches, mostly 'traditional' education or training (6 studies), (2) more elaborate empirical designs that analyse certain factors within versions or models of CBE (11 studies) and (3) studies that employ surveys or other data in a mainly descriptive way to show or explain some aspects of CBE (6 studies). The remaining studies include some narrative literature-based contributions that point out certain problems of CBE (5 studies) and systematic reviews (2 studies). What can we learn about effectiveness of CBE from these different kinds of studies? (see Table A.4ab in the annex for information on the studies).

The studies of type 1, using controlled comparisons of CBE practices, are dealing with a broad range of contexts and competencies, three school-related (elementary schools in Slovenia 2014, prevocational school in The Netherlands 2011 and teacher preparation in the USA 1972) and the remaining three in the fields of nursing education (Taiwan 2015), continuing education for general practitioners (Iran 2009) and consultants with teachers and parents (US 2004). These studies are mostly small scale (concern one or few courses at one school or university) and specific in content, and they by their majority give quite clear results in favour of CBE. The adverse result stems from a bigger study in the Netherlands, where the extent of CBE was varied in a quite abstract manner and where students developed more knowledge in learning situations with fewer characteristics of CBE.

The studies of type 2 do not allow conclusions about the effectiveness of CBE compared to other approaches but can elaborate on the understanding of how CBE might work, which factors are important, how it can be assessed and the like. A majority of these studies is originating in the Netherlands. A recent hot topic concerns the construction of instruments for self-assessment and the relationship of self-efficacy and earned credits, with ambiguous results; two contributions concern the self-perceived effects of CBE by polytechnic students in Ghana. A long-term case study analyses the broader political and sociological effects of the CBE reform in Australia from the 1990s in terms of the Foucaldian concepts of disciplinarity and governmentality (Hodge and Harris 2012). First, they show how the parameters of a vocational CBE programme have changed from being voluntarily piloted in the 1980s to becoming a part of the nationwide CBE reform in the 1990s. The actors were subsumed under a disciplinary regime by shifting the responsibility for the definition of competencies from the institution to the employers and by setting

tighter market regulations upon the financing of the institution. The authors cite their disappointed interviewees by saying 'I don't call Compentency Standards standards any more. You could drive a truck through the damned things', and 'It's all about funding; they don't care about anything else' (Hodge and Harris 2012, 160). Second, the CBE reform is shown as a vehicle to change the whole economic policy discourse in Australia into the neoliberal direction towards workers being responsible for training and employment in order to increase competitiveness.

Three older contributions in this group analyse effects of CBE in a US city, bringing about an increase of average test results in different subjects (1985), perceptions of CBE in relation to reflexivity among teacher students in a UK college (1999) and effects of CBE in higher-level vocational education in Scotland in terms of student experience and perception (2000). The analysis about effects of Scottish higher-level qualifications includes a broader review of existing studies, and the analysis of an extensive data sample about students indicates positive results of CBE for participants, however, a very low uptake and thus a very small contribution to the development of human capital.

The studies of type 3 include a wide range of topics that mostly do not answer questions of effectiveness of CBE. Students, parents and teachers of a public school at primary and secondary level in Hungary (2012) were surveyed to find out their opinions about a set of curricular initiatives towards CBE, with mostly positive responses about acceptance. Students in Informatics and Mathematics at Vilnius University (2009) expressed positive appraisals about European concepts towards CBE and quite negative views about the academic staff of the university. The analysis of access data of Norwegian higher education institutes and staff interviews (2006) indicated that the initiative to open access by the accreditation of prior learning (*realkompetanse*) has contributed to accessibility, however, somehow in an uneven manner towards institutions in more remote regions with lower supply of candidates. A bigger study about the impact of CBE in social work in Northern Ireland (2005) compared the opinions of workers trained before and after the reform, with quite positive results in favour for post CBE training. The biggest studies report about the development of 10 years CBE in Australian vocational education (Smith 1999a, b). Firstly they have analysed the process of implementation of CBE by developing an indicator based on 14 features, showing a much more slow pace than expected, and secondly effects on teaching and learning, providers, curriculum developers, teachers and trainers, students and trainees, staff development and policymakers. Concerning effects on competencies, the author reaches an ambiguous conclusion, saying that 'the system has evolved over the 10 years of its implementation to one which is workable, although there is some doubt about whether it is actually improving student and trainee outcomes and thereby helping to create a more skilled Australian workforce'(Smith 1999b, 115). Thirdly, the effects on teachers have been analysed showing that their role has only changed

to some degree 'from transmission to transaction' (Smith 1999a, 71), as far as self-paced learning has evolved, and ownership of knowledge was made more common among actors.

Review From the remaining contributions, Morcke et al. (2013) provide a historical review of effects of CBE in general and a systematic review of current empirical work about undergraduate medical education. From a search base of about 2.000 articles, they identified only 8 that fulfilled their criteria for review. Their findings are very few about teachers, showing on the one hand that learning outcomes might influence course planning and teaching and on the other that more experienced teachers might be limited by a focus on outcomes (ibid., 860). Concerning student learning some promotion of active learning, better preparation of teaching sessions, higher scores on tests and with more caveats, more self-evaluated competence and confidence was found. A negative finding is reported that only one third of students used the course objectives and, moreover, those had lower test scores. The authors conclude that 'OBE has been advocated and implemented in undergraduate medical education, but this has not been followed by substantial research on the impact of learning outcomes on teaching and learning medicine' (ibid., 860) and finally, 'We know little about what OBE is good for; what the connections are between learning outcomes and teaching; when outcomes are helpful for teachers and when not; when and how they are useful for self-directed learning'(ibid., 862).

31.4 Conclusions

Overall, we see in these results the wide room opened up by CBE and the diversity of its application as well as the diversity of trying to analyse it. Much heated ideological debates and heavy critiques can be found, whereas the empirical results are basically lacking. By and large, scholars are quite in favour of the analysed versions of CBE and in their observed aspects. The analyses have also found different kinds of approaches towards CBE, some that see and implement it as a broad systemic political solution (as, e.g. in Australia or the UK for some time) and echoed by the EU currently, and others that follow it rather at a smaller scale and concrete level of an occupation or a profession (as, e.g. in fields of medicine or health professions). The latter more concrete approach seems the more promising one that also avoids the big ideological fights.

The review undertaken in this chapter must be seen as an explorative one, which has tried to establish a big picture of the field. It can be finished with a plea for a follow-up on this path of review, going deeper into the different aspects, widening the searches and improving the ratings of the material.

Annex Tables/Figures

Table A.1 EBSCOHOST searches

SEARCH EBSCOHOST Education Research Complete (end January 2015)		Average hits per year		
	Hits 1976–2014	*1976–2014*	*1991–2010*	*2011–2014*
(1) CBE: 'competence-based education' and 'effectiveness' and 'review' (all text)	210	5,4	6,9	18,0
Thereof word search '*effect*' in titles and abstracts	58	1,5	1,8	5,5
(2) CBT: 'competence-based training' and 'effectiveness' and 'review' (all text)	150	3,8	5,7	9,0
Thereof word search '*effect*' in titles and abstracts	32	0,8	1,1	2,8
(3) OBET: 'outcome-based education' or 'outcome-based training' (title)	128	3,3	5,0	6,3
Thereof word search '*effect*' in titles and abstracts	35	0,9	1,1	3,0
(4) COBL: 'competence' or 'competency' or 'outcome-based learning' (title)	164	4,2	4,0	19,8
Thereof word search '*effect*' in titles and abstracts	59	1,5	1,3	8,5
(1)–(4) Search hits total, gross[a] all expressions	652	16,7	21,5	53,0
Thereof word search '*effect*' in titles and abstracts	184	4,7	5,2	19,8
Proportion of hits that include 'effect' in title and abstract/all hits				
% 'effect' in hits (1) CBE	13 %	13 %	20 %	32 %
% 'effect' in hits (2) CBT	11 %	11 %	15 %	27 %
% 'effect' in hits (3) OBET	21 %	21 %	22 %	47 %
% 'effect' in hits (4) COBL	15 %	15 %	20 %	42 %
% 'effect' in hits total	16 %	16 %	20 %	37 %

[a]Not controlled for double counting of articles in the different searches

Table A.2 Google searches

SEARCH Google and Google Scholar (end January 2015)				
	Overall search		Scholar search	
Competence-based education and training	~95.2 Mio. hits	100 %	1.580.000 hits	100 %
Competency-based education and training	~4.2 Mio. hits	4 %	416.000 hits	26 %
Outcome-based education and training	~30.7 Mio. hits	32 %	3.440.000 hits	218 %
Competence-based learning	~167.0 Mio. hits	175 %	1.920.000 hits	122 %
Competency-based learning	~4.8 Mio. hits	5 %	442.000	28 %

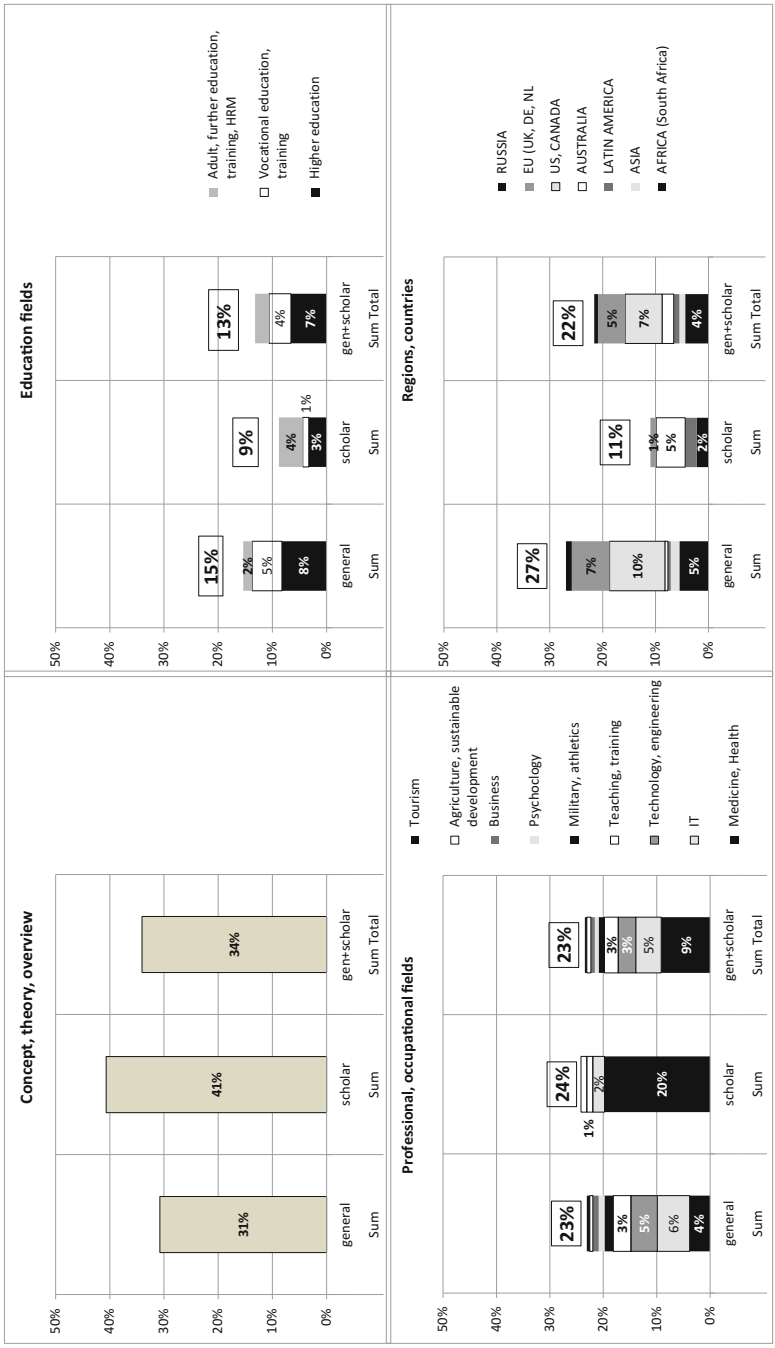

Fig. A.1 Google searches, overview about distribution of topics and regions of top 20 ranked hits

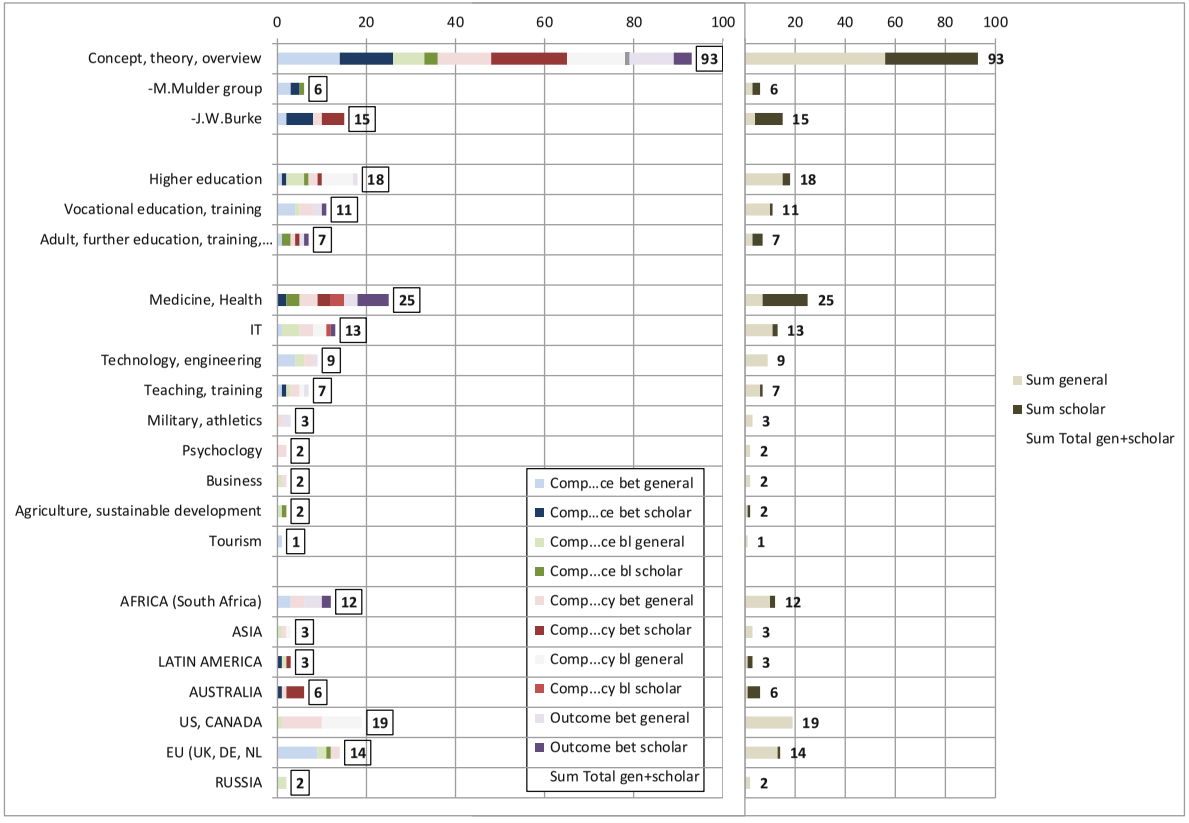

Fig. A.2 Google searches, overview about topics and regions of top 20 ranked hits, absolute numbers

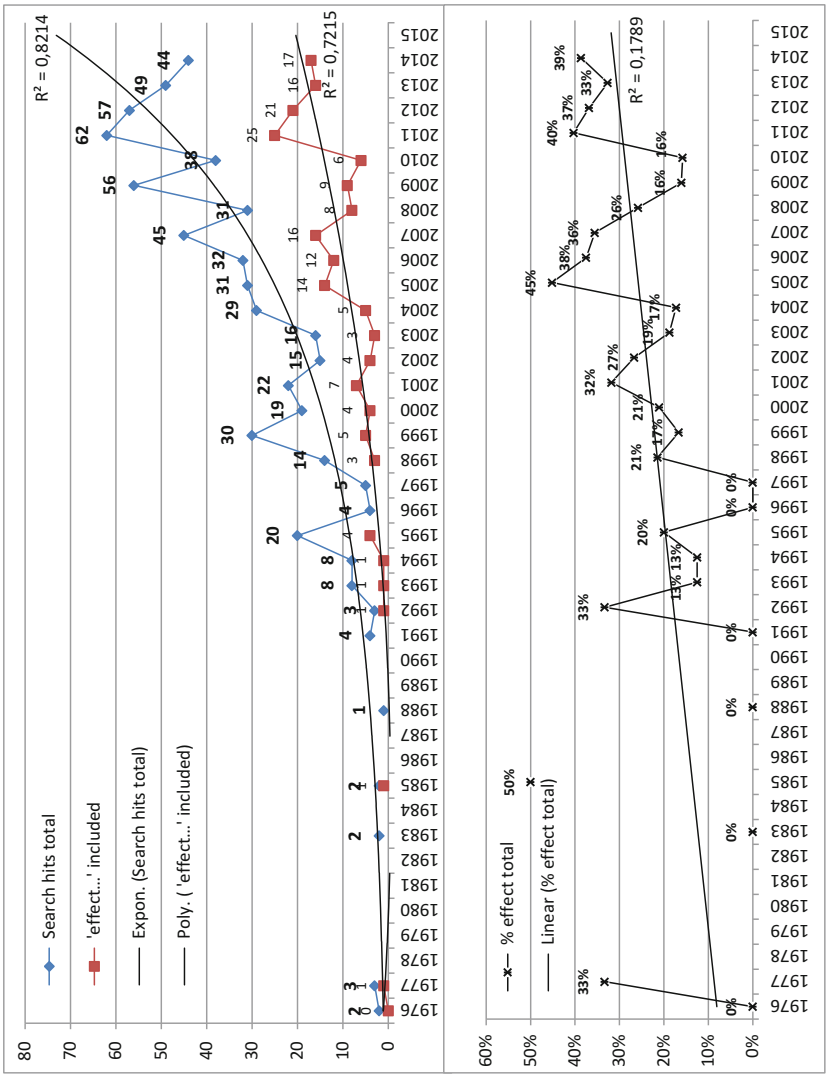

Fig. A.3 Total number of hits in search EBSCOHOST 1976–2014, proportion of 'effect' in titles and abstracts

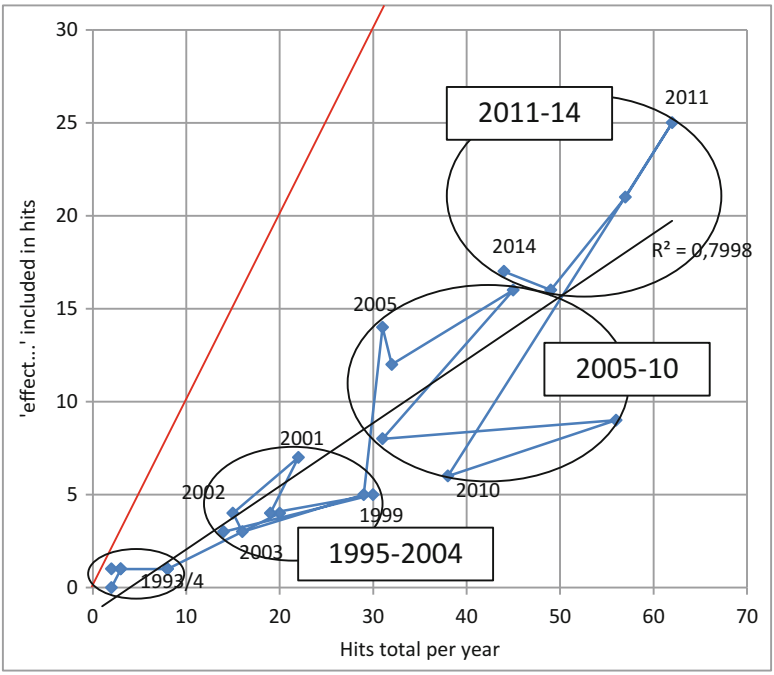

Fig. A.4 Time related pattern of search hits total and 'effective' included

Table A.3 Contributions from searches starting with educational effectiveness, combined with competence/competency or outcome

Year	Title, authors, source
	Search 'effective'
2014	Effects of a Live Educational Music Therapy Intervention on Acute Psychiatric Inpatients' Perceived Social Support and Trust in the Therapist: A Four-Group Randomized Effectiveness Study. By Silverman, Michael J. Journal of Music Therapy. Fall 2014, Vol. 51 Issue 3, p. 228–249
2013	Dental Student Perceptions of Case-Based Educational Effectiveness. By McKenzie, Carly T. Journal of Dental Education. Jun 2013, Vol. 77 Issue 6, p. 688–694
	Search 'outcome'
2010	School Factors Explaining Achievement on Cognitive and Affective **Outcomes**: Establishing a Dynamic Model of Educational Effectiveness. By Creemers, Bert; Kyriakides, Leonidas. Scandinavian Journal of Educational Research. Jun 2010, Vol. 54 Issue 3, p. 263–294
2014	Effects of a Live Educational Music Therapy Intervention on Acute Psychiatric Inpatients' Perceived Social Support and Trust in the Therapist: A Four-Group Randomized Effectiveness Study. By Silverman, Michael J. Journal of Music Therapy. Fall 2014, Vol. 51 Issue 3, p. 228–249
2013	Using the Dynamic Model of Educational Effectiveness to Identify Stages of Effective Teaching: An Introduction to the Special Issue. By Creemers, Bert P. M.; Kyriakides, Leonidas. Journal of Classroom Interaction. 2013, Vol. 48 Issue 2, p. 4–10
2012	A Study of the Effectiveness of Supplemental Educational Services for Title I Students in Baltimore City Public Schools. By Harding, Heather R.; Harrison-Jones, Lois; Rebach, Howard M. Journal of Negro Education. Winter 2012, Vol. 81 Issue 1, p. 52–66
2007	The Birth to School Study: evidence on the effectiveness of PEEP, an early intervention for children at risk of educational under-achievement. By Evangelou, Maria; Brooks, Greg; Smith, Sally. Oxford Review of Education. Nov 2007, Vol. 33 Issue 5, p. 581–609
2007	Educational psychology and the effectiveness of inclusive education/mainstreaming. By Lindsay, Geoff. British Journal of Educational Psychology. Mar 2007, Vol. 77 Issue 1, p. 1–24
2004	The impact of multifaceted educational structuring on learning effectiveness in a surgical clerkship. By Van Der Hem-Stokroos, H. H.; Daelmans, H. E. M.; Van Der Vleuten, C. P.; Haarman, H. J. Th.; Scherpbier, A. J. J. A. Medical Education. Aug 2004, Vol. 38 Issue 8, p. 879–886

Source: Searches in EBSCOHOST Jan 2015 [searches B, C in http://www.equi.at/dateien/cbe.pdf]

Table A.4 Contributions from searches starting with expressions of CBET and including effectiveness

Year	Title, authors, source	Methodology, remarks
(a) Search using expression 'competence-based education/training'		
'effect' FOUND IN TITLE/ABSTRACT and corrected by inspection		
2014	Exploring the Validity and Robustness of a Competency Self-Report Instrument for Vocational and Higher Competence-Based Education. By Khaled, Anne E.; Gulikers, Judith T. M.; Tobi, Hilde; Biemans, Harm J.A.; Oonk, Carla; Mulder, Martin. Journal of Psychoeducational Assessment. Aug 2014, Vol. 32 Issue 5, p. 429–440	Netherlands, empirical and conceptual, integrating theory and practice, pilot-study in VET and HE, 351 students, difference concrete/abstract competencies (*type ii*)
2014	Student perceptions of assessment and student self-efficacy in competence-based education. By van Dinther, Mart; Dochy, Filip; Segers, Mien; Braeken, Johan. Educational Studies. Jul 2014, Vol. 40 Issue 3, p. 330–351	Empirical, studies relations between assessment characteristics, self-efficacy and outcomes (*type ii*)
2012	ADAPTATION ANALYSIS OF SOME ALTERNATIVE COMPETENCE-BASED EDUCATION PROGRAMS' IN A HUNGARIAN PUBLIC SCHOOL. By Hanák, Zsuzsanna; Dorner, László. Problems of Education in the twenty-first Century. 2012, Vol. 39, p. 52–61	Conceptual and empirical, small study (1 school, 158 participants) survey about perceptions of CBE characteristics (*type iii*)
2009	[DOUBLE across] Does an outcome-based approach to continuing medical education improve physicians' competencies in rational prescribing? By Esmaily, Hamideh M.; Savage, Carl; Vahidi, Rezagoli; Amini, Abolghasem; Dastgiri, Saeed; Hult, Hakan; Dahlgren, Lars Owe; Wahlstrom, Rolf. Medical Teacher. Nov 2009, Vol. 31 Issue 11, p. e500–e506	Iran, empirical, specific occupation, studies effects of CBE on certain behaviour of general practitioners, survey 112 participants (*type i*)
2003	Approved Social Work Training in Northern Ireland: Using Research to Examine Competence-based Learning and Influence Policy Change. By Wilson, George; Hamilton, Bernadette; Britton, Frank; Campbell, Jim; Hughes, Phil; Manktelow, Roger. Social Work Education. Oct 2005, Vol. 24 Issue 7, p. 721–736	Review of effectiveness of CBE, specific occupation, based on literature, no clear result (*type iii*)
1999	Where's the Competence in Competence-based Education and Training? By Lum, Gerard. Journal of Philosophy of Education. Nov 99, Vol. 33 Issue 3, p. 403	Conceptual discussion of CBE, critical to approach
'effectiveness' as topic found by inspection of abstract		
2014	DEVELOPMENT AND EVALUATION OF A COMPETENCE-BASED TEACHING PROCESS FOR SCIENCE AND TECHNOLOGY EDUCATION. By Pešaković, Dragica; Flogie, Andrej; Aberšek, Boris. Journal of Baltic Science Education. 2014, Vol. 13 Issue 5, p. 740–755	Slovenia, instruments for measurement, case of elementary education (*type i*)

(continued)

Table A.4 (continued)

Year	Title, authors, source	Methodology, remarks
2013	The relationship between perceived competence and earned credits in competence-based higher education. By Kamphorst, J.C.; Hofman, W.H.A.; Jansen, E.P.W.A.; Terlouw, C. Assessment & Evaluation in Higher Education. Sep 2013, Vol. 38 Issue 6, p. 646–661	Netherlands, empirical, higher education, explaining perceived competence and earned credits by learning process factors (*type ii*)
2013	The construct validity and predictive validity of a self-efficacy measure for student teachers in competence-based education. By van Dinther, Mart; Dochy, Filip; Segers, Mien; Braeken, Johan. Studies in Educational Evaluation. Sep 2013, Vol. 39 Issue 3, p. 169–179	Empirical, teacher education, analysing factors influencing self-efficacy in a competence framework (*type ii*)
2012	A critical time for medical education: the perils of competence-based reform of the curriculum. By Malone, Karen; Supri, Salinder. Advances in Health Sciences Education. May 2012, Vol. 17 Issue 2, p. 241–246	International, medical education, review, lessons from history of CBE
2011	Development of student knowledge in competence-based prevocational secondary education. By Koopman, Maaike; Teune, Peter; Beijaard, Douwe. Learning Environments Research. 2011, Vol. 14 Issue 3, p. 205–227	Netherlands, empirical, prevocational schools, teacher questionnaire, student knowledge depending on extent of CBE (*type i*)
2009	TRANSFORMATION OF UNIVERSITY: TOWARDS PRAGMATISM AND COMPETENCE-BASED EDUCATION. UNIVERSITETŲ KAITA: PRAGMATIZMO IR KOMPETENCIJŲ UGDYMO LINK. By Bulajeva, Tatjana; Duoblienė, Lilija; Targamadzė, Vilija. Pedagogy Studies/Pedagogika. 2009, Issue 93, p. 9–16	Lithuania, empirical, higher education IT, students, two master programmes, competencies, idea of university and CBE (*type iii*)
2000	The rhetoric and reality of professional competence-based vocational education in Scotland. By Canning, Roy. Research Papers in Education. Mar 2000, Vol. 15 Issue 1, p. 69–93	UK, Scotland, empirical, level 4–5 professional awards, 236 students, survey experience (*type ii*)
1999	Relationship between competence-based education and student reflection on practice: a UK case study of initial teacher training. By Burchell, Helen; Westmoreland, Susan. International Journal of Training & Development. Jun 99, Vol. 3 Issue 2, p. 156.	UK, empirical, teacher education, case study, one HE programme (*type ii*)
(b) Search using expressions 'competency/outcome-based education/training'		
A. search TITLE 'competency-based education/training, 'effect' FOUND IN ABSTRACT		
2015	Performance evaluation of nursing students following competency-based education. By Fan, Jun-Yu; Wang, Yu Hsin; Chao, Li Fen; Jane, Sui-Whi; Hsu, Li-Ling. Nurse Education Today. Jan 2015, Vol. 35 Issue 1, p. 97–103	Taiwan, empirical, nursing, quasi-experimental CBE vs. traditional, 4 scales (312 undergraduates) (*type i)*

(continued)

Table A.4 (continued)

Year	Title, authors, source	Methodology, remarks
2014	Assessment criteria for competency-based education: a study in nursing education. By Fastré, Greet; Klink, Marcel; Amsing-Smit, Pauline; Merriënboer, Jeroen. Instructional Science. Nov 2014, Vol. 42 Issue 6, p. 971–994	Netherlands-Belgium, empirical, nursing, secondary VET, CB vs. performance-based assessment criteria on outcomes (*type ii*)
2014	Perceived effects of competency-based training on the acquisition of professional skills. By Boahin, Peter; Hofman, W.H. Adriaan. International Journal of Educational Development. May 2014, Vol. 36, p. 81–89	Ghana, empirical polytechnic, students perceptions (316 students, randomly, stratified selected) (*type ii*)
2013	A disciplinary perspective of competency-based training on the acquisition of employability skills. By Boahin, Peter; Hofman, Adriaan. Journal of Vocational Education & Training. Sep 2013, Vol. 65 Issue 3, p. 385–401	
2013	[DOUBLE] Outcome (competency)-based education: an exploration of its origins, theoretical basis and empirical evidence. By Morcke, Anne; Dornan, Tim; Eika, Berit. Advances in Health Sciences Education. Oct 2013, Vol. 18 Issue 4, p. 851–863	Medical education, systematic review of effects 1999–2010
2012	Discipline, governmentality and 25 years of competency-based training. By: HODGE, STEVEN; HARRIS, ROGER. Studies in the Education of Adults. Autumn 2012, Vol. 44 Issue 2, p. 155–170	Australia, conceptual case study, broader political effects of CBT (*type ii*)
2004	[DOUBLE] Competency-Based Behavior Consultation Training: An Evaluation of Consultant Outcomes, Treatment Effects, and Consumer Satisfaction. By Kathy Lepage; Thomas R. Kratochwill; Stephen N. Elliott. School Psychology Quarterly. Spring 2004, Vol. 19 Issue 1, p. 1–28	USA, empirical, small scale (24 consultants, 39 clients: teachers, parents, consultation skills, client behaviour (*type i*))
1999	Ten years of competency-based training: the experience of accredited training providers in Australia. By Smith, Erica. International Journal of Training & Development. Jun 99, Vol. 3 Issue 2, p. 106	Australia, summary of two projects, 1990s, effects of CBT (*type iii*)
1999	How Competency-Based Training has Changed the Role of Teachers in the Vocational Education and Training Sector in Australia. By Smith, Erica. Asia-Pacific Journal of Teacher Education. Mar99, Vol. 27 Issue 1, p. 61	Australia, summary of research project about effects of CBT (*type iii*)
1972	The Effects of Competency-Based Training on the Performance of Prospective Teachers. By Waimon, Morton D.; Bell, Dennis D.; Ramseyer, Gary C. Journal of Teacher Education. Summer 1972, Vol. 23 Issue 2, p. 237–245	USA, empirical, teachers, microplanning, microteaching (*type i*)

(continued)

Table A.4 (continued)

Year	Title, authors, source	Methodology, remarks
B. Search TITLE 'outcome-based education/training, 'effect' FOUND IN ABSTRACT		
2013	[DOUBLE: Outcome (competency)-basededucation: an exploration of its origins, theoretical basis, and empirical evidence. By Morcke, Anne; Dornan, Tim; Eika, Berit. Advances in Health Sciences Education. Oct 2013, Vol. 18 Issue 4, p. 851–863]	See above
2009	[DOUBLE across] Does an outcome-based approach to continuing medical education improve physicians' competencies in rational prescribing? By Esmaily, Hamideh M.; Savage, Carl; Vahidi, Rezagoli; Amini, Abolghasem; Dastgiri, Saeed; Hult, Hakan; Dahlgren, Lars Owe; Wahlstrom, Rolf. Medical Teacher. Nov 2009, Vol. 31 Issue 11, p. e500–e506	See above Table A.4a
2007	Outcomes-based education? Rethinking the provision of compulsory education in Western Australia. By Berlach, Richard G.; McNaught, Keith. Issues in Educational Research. Apr 2007, Vol. 17 Issue 1, p. 1–14	Australia, review, compulsory education, broader effects on education
2004	[DOUBLE] Competency-Based Behavior Consultation Training: An Evaluation of Consultant Outcomes, Treatment Effects, and Consumer Satisfaction. By Kathy Lepage; Thomas R. Kratochwill; Stephen N. Elliott. School Psychology Quarterly. Spring 2004, Vol. 19 Issue 1, p. 1–28	See above
2000	Effects of a shared vision on the attitudes of teachers towards outcomes-based education. By: Singh, P.; Manser, P.G. South African Journal of Education. May 2000, Vol. 20 Issue 2, p. 108	South Africa, education staff, broader effects (attitudes, leadership, etc.)
1999	Empowering or Ensnaring?: The Implications of Outcome-based Assessment in Higher Education. By: Ecclestone, Kathryn. Higher Education Quarterly. Jan 1999, Vol. 53 Issue 1, p. 29	UK, review, higher education, GNVQ, broader effects (attitudes teachers, students)
1994	The possible outcomes of outcome-based education. By McGhan, Barry. Educational Leadership. Mar 1994, Vol. 51 Issue 6, p. 70	USA, forecasting effects of OBE
1985	Making Outcome-Based Education Work. By Abrams, Joan D. Educational Leadership. Sep 85, Vol. 43 Issue 1, p. 30	USA, regional effects (*type iii*)

Two contributions were excluded here because they do not refer to versions of CBE: Marketing to increase participation in a Web-based continuing medical education cultural competence curriculum. By Estrada, Carlos A.; Krishnamoorthy, Periyakaruppan; Smith, Ann; Staton, Lisa; Korf, Michele J.; Allison, Jeroan J.; Houston, Thomas K. Journal of Continuing Education in the Health Professions. Winter 2011, Vol. 31 Issue 1, p. 21–27; and [Active interprofessional education in a patient based setting increases perceived collaborative and professional competence. By Hallin, Karin; Kiessling, Anna; Waldner, Annika; Henriksson, Peter. Medical Teacher. Feb 2009, Vol. 31 Issue 2, p. 151–157.]; three contributions not dealing with effectiveness were excluded from those found in title/abstract; further three contributions found were books reviews (two books), which were also excluded from the analysis

Source: Searches in EBSCOHOST Jan 2015 [documented in http://www.equi.at/dateien/cbe.pdf for searches in section (a) and http://www.equi.at/dateien/cbet.pdf for searches in section (b)]

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Chapter 32
Areas of Learning: The Shift Towards Work and Competence Orientation Within the School-based Vocational Education in the German Dual Apprenticeship System

Michael Gessler

32.1 Introduction

In Germany, the dual system of vocational education and training is carried out parallel in companies (normally 3 days a week) and in vocational schools (normally 2 days a week). There are statutory regulation documents for the goals, content and timetable structures for the vocational education and training at the two learning locations: The companies are governed by *training regulations* and the vocational schools by *framework curricula*. There is no regulation that incorporates both (e.g. an integrated training and education plan) or is equally valid for both learning locations due to the federal structure of Germany and jurisdiction being shared between federal government and state government.

The federal government is responsible for training regulations (usually the Federal Ministry for Economics and Technology) based on the German Vocational Training Act of 1969 (amended in 2005; covering among others the following apprenticeship trainings: industrial clerk, information technology specialist) or based on the Crafts Code of 1953 (amended in 2004; covering among others the following apprenticeship trainings: electronics technician, carpenter). In accordance with Section 5 of the German Vocational Training Act or the Section 26 of the Crafts Code, the following five points must be established in a training regulation:

- Name of vocation and recognised apprenticeship training
- Length of vocational education and training (as a general rule, no longer than 3 years and no shorter than 2 years)
- Vocational profile/training objectives (vocational skills, knowledge and abilities)

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- Structure of the apprenticeship/training framework (plan that includes content and timetable for passing on vocational skills, knowledge and abilities)
- Examination requirements

The vocational schools' curricula are made for the 16 states (Länder) by the 16 states' Ministries of Education. This means: There are currently approx. 330 recognised apprenticeship trainings with approx. 330 federal training regulations (first pillar) leading to 330 vocations. Due to the states' jurisdiction over their own education policies, each state could therefore theoretically issue its own curriculum (second pillar) for the school-based vocational education ($330 \times 16 = 5280$). This approach consumed in the past an enormous amount of time for each state (Land) and led to different school-based vocational education in the various states. For this reason, the following system has been established: new and further development of curricula for vocational education in schools are coordinated by the Standing Conference of the Ministers of Education and Cultural Affairs (KMK), a voluntary coordinating body for the 16 state ministries without constitutional status (first congress in 1948). The developed curricula, so-called KMK framework curricula, are subsequently adopted by each of the state ministries (usually without applying any further changes). The new and further development of training regulations for vocational training in companies on the other hand is carried out by the Federal Institute of Vocational Training (BIBB; founded in 1970) on behalf of the Federal Ministry.

Although there is no single regulation for the two learning locations, in 1972 there has been a formal agreement between the Federal Government and the KMK (or state governments). This agreement specifies that the new and further development of training regulations and the new and further development of a KMK framework curricula are coordinated alongside one another and together with the relevant experts responsible for the regulations' new and further development. The experts from the Federal Institute of Vocational Training (BIBB) are generally representatives of employers' and employees' associations. That means that the training regulations for companies are developed by industry or craft representatives. The KMK's experts, on the other hand, are generally teachers from vocational schools. Table 32.1 provides an overview outline of the structure of the dual system of vocational education and training in Germany.

The formal administrative agreement of 1972 constituted an important step in overcoming the formal duality of jurisdictions. The agreement was a necessary step for integrating the separate jurisdictions into one combined system and for it even to be called a dual system. It was a necessary step, but it was not wholly sufficient. Up until the mid-1990s, one key problem was that the training regulations and the framework curriculum did not fit with one another in terms of content and objectives. The respective system logics were just too different, with the acquisition of practical and applicable know-how on the one hand (companies) and abstract and systematic theoretical knowledge on the other (schools).

Since the concept *areas of learning* (German = Lernfeldkonzept) was introduced in 1996 as a structural principle for the KMK framework curricula, the requirements for vocational education in schools had to be redefined. The reform ended up being

Table 32.1 Jurisdictions in the dual system of vocational education and training

	Dual system of vocational education and training for approx. 330 recognised vocations		
Learning location	Company		School
Jurisdiction	Federal government		State government
Statutory basis	Industry	Craft	Individual federal states' education acts
	Vocational Training Act	Crafts Code	
Focus	Vocational training		Vocational education
Regulations	Training regulations		Framework curriculum
New and further development of regulations	Federal Institute for Vocational Training (BIBB)		Standing Conference of the Ministers of Education and Cultural Affairs of the Länder (KMK)
Appointed experts	Industry and craft representatives		School representatives (teachers)
Solution of separated jurisdiction	Joint agreement since 1972 between the federal government and the KMK/state governments on coordinating training regulations and framework curricula		

much less of an evolution rather than a revolution. The reform had wide-ranging consequences not only on the course and lesson design but also on the organisational framework conditions of the schools, the cooperation between schools and companies and the required qualification profile of the teachers.

In the school-based vocational education, the reform removed the concept of subjects and replaced them with areas of learning. The core tasks of the reform are (Bader and Schäfer 1998):

- Outcome orientation using 'vocational spheres of activity': The key goal of vocational education is no longer the orientation to reference (scientific) disciplines corresponding with subject logic (e.g. engineering, mathematics) but the orientation towards vocation-based work requirements or vocational spheres of activity. Learners are to be given the tools to tackle the vocational spheres of activity in companies, which are interrelated complex tasks important to the vocation and work in companies, but also personal and social life. Vocational spheres of activity are always multidimensional by linking together technical, social and personal problem tasks. The weighting between the dimensions may vary. A distinction between these three dimensions only serves analytical purposes.
- Process orientation using 'areas of learning': The school-based curriculum is no longer structured in subjects but constructed into work-oriented and process-related areas of learning. Areas of learnings are didactically founded equivalents of vocational spheres of activity that are handled at school. They are made up of complex tasks, which are then handled pedagogically using action-oriented learning situations. Areas of learning are target formulations in the context of competence descriptions and are specified through content summaries.

- Action-orientation using ‘learning situations’: Through the use of learning situations, vocational areas of learning are specified as complex teaching-learning arrangements that should require vocational actions, promote reflection and facilitate the accrual of applicable know-how. Learning situations put areas of learnings in concrete terms. Learning situations are developed in educational conferences by a team of teachers. The arrangements are work-oriented but didactically realised in the classroom and are accompanied by didactic reflection relevant to the vocation as well as individual and social life.

Since the mid-1990s and the introduction of the new concept, vocational education has experienced a work-oriented and competence-based turn. Its intended direction is an approximation of school-based learning to conditions within the marketplace. Various theories and development trends were taken up in this regard, such as action-theoretical approaches (Aebli 1980), the process orientation of lean management (Womack et al. 1994) or other reflections on situated knowledge and learning (Lave 1988; Lave and Wenger 1991).

The competence turn occurred one decade later and in the opposite direction within general education: an approximation of school-based learning to the systematics of the reference disciplines. These two differing directions are described in the following section of this chapter.

32.2 Concepts of Competence-based Education

There are today different approaches to competence-based education within the general educational schooling system and vocational education and training system in Germany. The emergence of these differing concepts, their differing backgrounds and diverging understanding of concepts are demonstrated in the following two subsections.

32.2.1 Work Orientation Versus Science Orientation

The discussion about whether vocational education in vocational schools required a new foundation initially started in Germany in the 1980s. The competence-based turn in vocational education finally took place in the 1990s. Since 1991, the ultimate goal of vocational education has been *competence to act.* This ultimate goal led to the formulation of an action-oriented education as a didactic guiding principle (KMK 1991). Then came the curricula change in 1996; until 1996 all content matter at vocational schools had been taught systematically. Since 1996, the content matter is no longer oriented to the reference disciplines (e.g. engineering) but to the actual work requirements (KMK 1996/1999). In the future, trainees should learn how to master vocational and professional challenges also within the school setting. The

classic distinctions of 'theory equals school-based learning' and 'practical experience equals work-based learning in companies' or 'knowledge equals school-based learning' and 'know-how equals work-based learning in companies' are to be removed through the orientation of school-based content to the practical requirements of the vocational and professional work. It is no longer the inputs (useful knowledge) but rather the outputs (holistic vocational activities structured into areas of learning) that are defined. The reform introduced a work-centred turn in the school-based component of dual vocational education and training. The reform was triggered during the 1980s by companies' heavy criticisms of the school-based education as useless for the work requirements and the needs of the companies (Gerds 2001).

In the 1990s, the general education system had to prioritise a different task: the new federal states (previously the German Democratic Republic aka East Germany) of reunified Germany had to adapt and/or build up from scratch their general education system to introduce and stabilise the new form of society (social market economy rather than socialism). The 'old' Federal Republic of Germany supported this reconstruction with its three-tiered school system of Hauptschule (secondary general school), Realschule (intermediate secondary school) and Gymnasium (grammar school), stemming from the Weimar Republic (1918 to 1933) and therefore somewhat antiquated by then. The competence-based turn took place in the general educational school system a decade later, from 2001 onwards. This time it was not the industry that triggered the change but the bad results (from a German perspective) of students compared internationally as part of the Programme for International Student Assessment (PISA) carried out by the Organisation for Economic Cooperation and Development (OECD). Initially the PISA results triggered a state of shock in the general educational school system, which then led to a wave of reforms. Only very little would presumably have occurred after the physical exertion in the 1990s without this impetus from outside; the general education system had already restabilised itself and was back to normal. The OECD/PISA feedback only affected the general education school system, not the dual vocational education and training system. The vocational education within the dual system had distanced itself from the scientific concept and introduced the action principle oriented towards skilled labour. In the 2000s, the key task for vocational schools within the dual system was on how to make complex vocational-operational tasks accessible in a school-based learning setting and how these could not only be experienced theoretically and reflectively but also oriented towards practice and experience.

The reforms in the general education systems, on the other hand, were targeted at strengthening the scientific principles: 'Subjects taught correspond with scientific disciplines that develop particular world views (historic, literary-cultural, scientific etc.), while introducing particular 'codes' (e.g. mathematical models, hermeneutic text interpretation)' (Klieme et al. 2003, p. 18, translated from German by the author). In the 2000s, especially, representatives of educational psychology and subject didactics in general education design competence models with structural models on the one hand and level stage models on the other, oriented by traditional profiles (including linguistic/literary, mathematical/scientific, historic/social and

aesthetic/expressive). Common to both paths is that the outcomes are placed in the fore. How the two education systems are managed (vocational education and general education) is oriented towards the question of what somebody should ultimately be able to do. The important difference between the two is what guiding paradigm their competence is based on.

- Science, systematic and subject orientation in general education: In order to apply and transfer knowledge, it must be ordered systematically and should therefore be taught and learned systematically. Developing this systematic behaviour is the key role within the scientific discipline and subject didactics. The teachers' responsibility is to solidify the subject-structured content (e.g. mathematics, physics) in class using various social applications (e.g. 'You would like to conclude a mobile phone contract…').
- Work, situation and action orientation in the dual VET-System: In order to apply and transfer knowledge, it should be situated and should therefore be taught and learned using situated vocational and professional problems. The professional problems are provided using operational requirements or a job's action logic (where action logic is expressed in actual business and work processes). The responsibility of the teachers at the schools is to incorporate the vocational and professional problems indicated on the framework curriculum into learning situations for class (e.g. for the career of Electronics Technician: 'You would like to install a satellite dish at a private household…').

The challenges can vary accordingly: while, for instance, mathematics is basically identical across cultural borders (and is therefore particularly suited for international comparisons), vocational and professional skills do not reflect a single dimension, but are always related to relevant cultural, political, organisational and situational requirements. Accordingly, a comprehensive definition of competence is needed in vocational education and training, which considers not only the technical competence but also the social and personal (self) competence. In this context, mathematical competence is just a subsegment of technical competence and may, for instance, be mostly useless without know-how and social and personal competence in work-related situations (e.g. 'How would I justify a decision to a customer?'). However, mathematical competence is a standalone competence in general education that can be structured (e.g. mathematical argumentation, mathematical modelling, mathematical representations) and scaled (e.g. reproduction, generalisation, reflection).

Table 32.2 illustrates as an overview of the key differences between competence-based education in the general education and in the dual system of vocational education and training (see also Sloane and Dilger 2005).

In vocational education and training, the concept of work-oriented competence currently holds about as much sway in Germany as the little Gaul village used to in Ancient Rome. It does not fit into the national context of general education, and it does not fit into the international OECD/PISA context. The 'little Gaul village'

Table 32.2 Competence-based education in general and vocational education

	Competence-based orientation in	
Characteristic	Vocational education	General education
Principle of control (old)	Input orientation	Input orientation
	Purpose in schools: Acquisition of systematic knowledge	Purpose in schools: Acquisition of systematic knowledge
Trigger	Criticism by the industry: The school-based vocational education does not contribute to meeting vocational and professional challenges but only provides abstract and useless knowledge	PISA comparison study by OECD: Performance by German pupils is only average when compared internationally
Begin	1990	2000
Principle of control (new)	Outcome orientation	Outcome orientation
	Purpose: Meeting vocational and professional challenges	Purpose: Meeting subject challenges
Guiding paradigm	Vocation and work	Science and subject
	Situated	Systematic
Competence	Competence = Integration of differing skills and abilities in order to perform successfully within a specific domain	Competencies = Sum of various cognitive abilities with different qualitative levels in order to solve problems in a specific domain
Domain	Definable vocational sphere of activity (e.g. mechatronics)	Subjects (e.g. mathematics)

comparison is also quite applicable, because the concept of work-centred competence and the concept of areas of learnings only concern the dual system of vocational education and training in Germany. Besides this education and training option in form of a part-time vocational school (in the dual system, the school-based education takes place as mentioned on 2 days), in Germany exists also the option (in particular in the field of personal services provision, e.g. health care) to complete a fully school-based vocational education and training. In short, the work-centred competence-based turn only took place in the subsystem of 'vocational education' within the German education system and even here only in the subsystem 'dual system of vocational education and training'. A further analogy to our Gauls is that they enjoy a high level of sympathy. In a similar fashion, the German dual system of vocational education and training enjoys great international esteem, as this system is obviously both capable of achieving societal goals (for instance, a low unemployment rate) and economic goals (e.g. high economic power) according to the OECD (2010). These findings were made by the OECD, in other words, an organisation supporting a concept of competence not shared by the dual system of vocational training and education in Germany. To understand the conceptual differences, a deeper insight into the two competence-based approaches is required.

32.2.2 Competence to Act Versus Cognitive Competencies

In order to clarify the difference between the (reduced) concept of competence in general education and the (extended) concept of competence in vocational education and training, initially one should outline the concept of competence in general education.

32.2.2.1 Cognitive Competencies as the Key Concept of General Education

The normative foundations for reforms and competence-based education in the general education system were laid out in 2003 in the expert opinion 'to develop national education standards' (Klieme et al. 2003). Its logic consists of the following:

1. Educational goals (Bildungsziele) are only generally accepted statements and only reflect general expectations. They must therefore be put in concrete terms using competence requirements (Klieme et al. 2003, p. 20).
2. As part of a second step, Franz E. Weinert's comprehensive definition of the competence concept is used (ibid., p. 21 and p. 72), wherein competences are understood as 'the cognitive abilities and skills that individuals possess or can learn for solving specific problems, and the associated motivational, volitional and social readiness and abilities that enable them to use these solutions responsibly and successfully in a variety of situations' (Weinert 2001, pp. 27–28, translated from German by the author).
3. The next step introduces the premise of domains; here domains are equated with subjects. A distinction is drawn then between 'subjects' and 'non-subjects' (including personal and social competence) that are afterwards declassified as formless 'cross-disciplinary competences': 'Research would indicate that the development of cross-disciplinary competences assumes that extensive subject-based competences must already be in place' (Klieme et al. 2003, p. 75, translated from German by the author).
4. Following this division and categorisation, the conclusion is drawn that the formulation and the operationalisation of the competence concept ought to occur in a *subject*-specific way and that it would therefore be the responsibility of science-oriented subject didactics (or in English, science-oriented pedagogical content knowledge, PCK) to define competence models (ibid., p. 75).

Which logic is being applied here? The board is initially wiped clean. The arduous concept of 'Bildung' is rejected. Which understanding is thereby being pushed aside? The German Committee for Education (Deutsche Ausschuss für das Erziehungs-und Bildungswesen) used to define 'Bildung' in the 1960s as follows: 'Being educated means you are constantly attempting to better understand yourself, society and the world around you … it is not the brain that is educated, but the

whole person. … education rests considerably on an individual's own experiences … Being educated means listening and the ability to participate in discussion. … education is the ability to independently perform critique and critical trust' (Bohnenkamp et al. 1966, pp. 870–873).

The blank board is now refilled with Weinert's definition (see above). Nonetheless, Weinert's definition is also too wide-sweeping (in other words, social readiness and skills, responsible use of one's abilities), which is why it needs to be reduced further to make it one-dimensional measurable. At the end, only a fraction of Weinert's comprehensive understanding of competence remains: 'Competence' equals 'specialised competence', with the word specialism referring to a domain and domain being a teaching subject. The authors of the expert opinion 'to develop national education standards' therefore make an explicit distinction as to the comprehensive understanding of competence: 'The term competences used here should be expressly distinguished from the concepts that hail from vocational education and training and are frequently also used in public for technical, methodological, social and personal competence' (Klieme et al. 2003, p. 22, translated from German by the author).

32.2.2.2 Competence to Act as the Key Concept of Vocational Education and Training

In 1991, the Standing Conference of the Ministers of Education and Cultural Affairs (KMK) passed a framework agreement for the vocational schools: Vocational school provides a vocational basic and specialised education and thereby extends the previously acquired general education. This should enable a person to fulfil their challenges in the workplace as well as participate in shaping the working environment and society around them with social and environmental responsibility. Vocational school aims to provide the vocational skills by combining technical competence with general competence such as human and social competence (KMK 1991; see also Rauner 1988). The triad of competences (technical competence, human competence and social competence) has a long tradition in Germany (Roth 1971). Before introduction of the concept areas of learning, it already formed a central basic idea within vocational education and training. This concept was seized up again within the areas of learning concept and summarised with the term 'competence to act': Part of the vocational school's aim is to impart vocational competence to act and extend the general education (KMK 2011). Competence to act comprises the dimensions of specialised technical competence, self-competence and social competence. On one hand, these dimensions are dependent, interconnected and cannot be developed independent of one another. On the other hand, these dimensions provide reference points and can be considered separately in order to pay attention that the three dimensions are demonstrated sufficiently. The three competence dimensions of competence to act can be defined as follows (Bader and Müller 2002):

- *Technical competence* is the ability and readiness to handle tasks independently, technically correctly and finally assess the outcome. This also involves extra-functional skills such as logical, analytical, abstract, integrated reasoning as well as the recognition of interconnected systems and processes. Regarding the training regulations for vocational education and training, corresponding specialist competence corresponds with the objective of enabling the performance of a vocation that involves independent planning, implementation and monitoring in particular.
- *Self-competence* describes the ability and readiness of a person to clarify, reflect on and assess for themselves the developmental opportunities, requirements and restrictions of work, family and public life, develop their own talents as well as conceive and develop their own life plans. Among others, this also entails developing well-thought-out moral values and a self-determined commitment to specific values.
- *Social competence* describes the ability and readiness to conceive and comprehend social relationships and interests, affection and tension as well as reason and communicate with other people rationally and responsibly. This also involves the development of social responsibility and solidarity.

The three dimensions are emphasised using three transversal types of competence. These three types of competence – communicative competence, methodological competence and learning competence – are not independent dimensions but emphases within the three abovementioned dimensions. The three accentuating competences can be defined as follows (Bader and Müller 2002):

- *Communicative competence* refers not only to the ability and readiness to share with one another issues and feelings via verbal (spoken and written) and formal (formulaic, visual) languages but also through non-verbal means (gesticulation and facial expression). This also encompasses the ability to perceive, understand and express one's own intentions and needs and those of others. The objective is therefore to understand and shape communicative situations.
- *Methodological competence* describes the ability and readiness to proceed in a targeted and planned manner when handling vocational tasks and problems (e.g. when planning the process steps). Here learned thinking methods, procedures and solution strategies are independently selected, applied and, where necessary, developed further in order to handle tasks and problems. Methodical work includes independent design and assessment, which require initiative and creativity.
- *Learning competence* is the ability and readiness to comprehend, evaluate and integrate into their thought processes information regarding specific issues and relationships independently as well as together with others. In terms of professional work, learning competence develops through the mental processing of technical illustrations (sketches, wiring diagrams, professional articles), as well as in the comprehension and interpretation of social relationships and actions found in documentation by certain groups (newspaper reports, magazine articles, films, etc.). Importantly, learning competence also involves the ability and

readiness to develop and use in their further development learning techniques and strategies within and going beyond the vocational area.

This comprehensive concept of competence forms the basis for the concept areas of learning and the work-centred turn in vocational education in the dual system of vocational education and training. From this basis, the next step is to consider the development of the concept of areas of learning in its historic setting.

32.3 Design Principles of Vocational Curricula

A key question when developing curricula is to decide how to orient the objectives, content and methods and how to justify their relevance. Two major changes occurred: from work orientation to science orientation (in the 1960) and back with the reform in 1996 to work process orientation.

32.3.1 From Work Orientation to Science Orientation

At the beginning of the twentieth century in Germany, the purely vocational training system was complemented by a second pillar, school-based vocational education, ensuring that adolescents learn to (1) dutifully perform a vocation, (2) in order to take up a societal function using their profession, (3) thus stabilising their imperial state as dutiful citizens (Kerschensteiner 1901). According to Georg Kerschensteiner (founder of the vocational schools in Germany), such school-based vocational education would have to be grounded on work, not purely theory: 'Crafts are not just the basis of all art but also the basis of any real science. A public school designed to prepare for intellectual and manual professions is badly organised if it does not offer any facilities to develop the practical inclinations and abilities of a pupil.' (Kerschensteiner 1911/1922, p. 28, translated from German by the author). Education should therefore be geared towards practical interests and skills. Its model example is the autonomous master craftsman. With this educational concept, Kerschensteiner creates a fundamental idea, which has had a sustained impact on vocational education and training in Germany and, despite the later-mentioned orientation towards the scientific principle, has always remained as the fundamental consensus of vocational education and training (Gessler and Howe 2013).

In the beginning of the 1960s, the professionalisation of school-based vocational education and training in the technical area finally also reaches the teachers. The provision of teacher education then switched from the pedagogical institutes to universities, which also meant the entrance requirements changed. Instead of vocational education and training in connection with a further vocational training, the general educational Abitur (equivalent to A levels in the UK, BAC in France, high school level in the USA) and a short industrial internship were now preconditions

to enter teacher training. Subsequently, technology-oriented students of teacher education particularly attend engineering courses and commerce-oriented students of teacher education particularly attend economy-related courses. Key model examples are the academically qualified 'Diplom-Ingenieur' (Master of Engineering) or the similarly academically qualified 'Diplom-Kaufmann' (M.Sc. Business Administration). The universities' concept of being academically oriented rather than practice-oriented has been socialising this generation of teachers at vocational schools until today (Lipsmeier 1998).

In 1970, the German Education Council (a commission founded in 1965 by the Federal Government and the state governments that operated from 1966 to 1975) published recommendations for teacher education. These were as follows: (1) the principle of science orientation, 'the scientific orientation of subject matter and learning method is valid for all age groups' (Deutscher Bildungsrat 1972, p. 33), and (2) the principle of rationality, 'Besides the learning objectives and contents, the curriculum also determines the respective orders and learning steps as well as the various methods, materials and educational technologies. The learning objectives must be monitored' (ibid., p. 63). The recommendations strengthen the already-existing scientific principle, which is why in their vocational schools the academically trained teachers find a curriculum consisting of subject areas, narrowly formulated learning objectives and extensive content catalogues.

Table 32.3 provides, for example, purposes of an excerpt from a vocational school curriculum in 1983, specifically for a construction material tester class (Tenberg 2006). This example clearly demonstrates the compartmentalisation of objectives and units of time, the scientific orientation of the content detached from

Table 32.3 Vocational education and training curriculum from 1983

Learning objectives		Learning content	Methodological teaching notes	Time
1.4 Mass, density, force				
1.4.1.	Knowledge of the laws between mass, density and volume	Practical problem examples: determining the mass, density and volume of construction materials, e.g. a concrete part's bulk density	Only use SI units	3 h
			See textbook 'Praktische Fachkunde' (practical skills), section 1.2	
	Ability to perform technical calculations			
1.4.2.	Overview of the effect of forces	A force's changes of motion, position and shape, magnitude, direction and line of action	Examples demonstrations of a force's effect	1 h
			Force measurement using a spring balance	
	Ability to illustrate forces graphically	Force vector, force measurement scale, point load, surface load	The loading assumptions (dead weight, live load) according to DIN 1055 and DIN 1072 are only to be taught generically and in simplified form	

any operational purpose (thus therefore highly systematic) and the detailed methodological teaching notes. Such detailed guidelines could lead to asking whether professionalism were even required for teaching such material. Instead it brings up the image of an 'extended work bench'.

The scientific principle, as in the primacy of scientific content and scientific rationality, management and control, has become widely established and is set up and integrated across the board, from higher education, across curricula and to the lesson structures in a 45-min cycle. It just had one drawback: The industry had become dissatisfied with the development and particularly the outcome. And there was another competitor: the situation principle or the original idea of situated and action-oriented practical learning.

32.3.2 From Science Orientation to Situated Areas of Learning

During the 1980s, school-based education within the dual system of vocational education and training saw heavy criticisms. The industry's representatives particularly criticised that the school-based education was too theory intensive and far from reality, not contributing towards tackling the challenges of working life in the industry. In other words, the schools were not oriented towards the customer (Gerds 2001; Hüster and Gravert 2001).

Initially, Germany's Federal Institute for Vocational Training (BIBB) and its industrial social partners reacted to the growing critique with the upcoming reorganisation of metal and electrical vocations between 1987 and 1989. One key component of the reorganisation was that self-governance (the personality principle) as the ability for autonomous planning, autonomous implementation and autonomous monitoring was back in focus. As a consequence, the in-company practical examination was also modified: while previously only a job's final outcome was assessed, now an examinee's skills demonstrated in situ are assessed additionally to the outcome. The commission working in parallel to develop the teaching curricula for metal and electrical engineering also orient themselves according to the principle of personality. Their shared orientation was the model example of 'autonomous action'.

Shortly afterwards, in 1991, the Conference of the Ministers of Education and Cultural Affairs passed a framework agreement for vocational schools, setting decisive parameters. The vocational school's objective would be to provide a vocational basic and specialised education and extend the previously acquired general education. The vocational school aims to provide the trainee with the abilities to fulfil their vocation socially and ecologically responsibly and participate in shaping their working environment and community (KMK 1991).

In 1992, the KMK reacted once more to critique against vocational education and appointed a commission to revise the 'recommendations for the preparation of KMK framework curricula'. The commission submitted its first output in 1996. This was first tested in individual vocations and then passed as a binding basis.

What exactly are the recommendations that were compiled by the commission? The 'recommendations' describe how KMK framework curricula are developed, how they should be designed and what they should contain. Particularly the school-based vocational education is formulated and the guideline is laid down that KMK framework curricula are to be structured using areas of learning. Because the KMK framework curricula are mostly adopted by state ministries directly as curricula, these recommendations directly influence the education at the vocational school.

The new concept of 'areas of learning' does not completely abolish the dominant scientific principle of the mid-1990s, but it did introduce the situational principle, and the concept included above all that the scientific principle starts to fulfil a kind of service provider function for the situational principle: 'Areas of Learning are … thematic units that are oriented towards vocational tasks and procedures. In special cases, thematic units can also be included within areas of learning from an academic point of view. In any case, even for such units the connection with the work process should be made clear. Conveying orientational knowledge, system-oriented thinking and action, solving complex and example tasks as well as networked thinking are promoted particularly within an action-oriented classroom. It is therefore indispensable that the respective work and business processes are provided with the relevant academic background information' (KMK 1996/1999, p. 14).

Viewing the situational principle and the scientific principle as mutually exclusive would be of very little benefit to learning (Kremer 2003). Both principles possess different strengths. However, both principles also possess weaknesses, which could be compensated with the other respective principle's strength. The scientific orientation, for instance, enables the development of a well-structured knowledge base and thereby promotes the ability to reflect systematically; however, thereby neglecting the procedural and practical significance and applicability of the knowledge. The situational principle, on the other hand, promotes the situated applicability of knowledge and the development of personal and social competences, but this principle does not provide a systematic structure for this knowledge, which may prove problematic in the case of deeper professional reflection. A central question is also if problematic new actions need a different kind of knowledge as routine actions (Nickolaus 2014). The art consists of intermingling the two principles with one another. However, the normative basis of this new approach to education with vocational spheres of activity is shaped largely by the situational principle. What is overlooked here is the importance of other predictors such as previous and explicit technical knowledge, mathematical and linguistic prerequisite, general cognitive abilities, motivation, and interest in the apprenticeship training and vocation (Lehmann and Seeber 2007; Nickolaus 2013).

Up until 1996, the framework curricula were structured according to areas of learning. The following excerpt from KMK framework curricula for industrial metal-working vocations from 1987 to 1996 demonstrates the old scientific principle and the structure according to engineering subjects. Afterwards and in contrast, a curriculum (Table 32.4) following the new concept will be presented.

Table 32.4 Framework curriculum for the recognised vocation of industrial mechanic

No.	Learning areas	Approximate time scales in hours			
		1st year	2nd year	3rd year	4th year
1	Production of components using hand-held tools	80			
2	Production of components using machines	80			
3	Manufacture of simple assemblies	80			
4	Maintenance of technical systems	80			
5	Production of parts using machine tools		80		
6	Installation and commissioning of control systems		60		
7	Fitting of technical subsystems		40		
8	Manufacture using numerically controlled machine tools		60		
9	Repair of technical systems		40		
10	Manufacture and commissioning of technical systems			80	
11	Monitoring product and process quality			60	
12	Maintenance of technical systems			60	
13	Ensuring the operation of automated systems			80	
14	Planning and implementation of technical systems				80
15	Optimisation of technical systems				60
	Overall (total of 1020 h)	*320*	*280*	*280*	*140*

- Basic education:
  - Introduction to manufacturing and testing engineering (120 h)
  - Introduction to materials engineering (20 h)
  - Introduction to machine and device engineering (20 h)
  - Introduction to control and information technology (60 h)
  - Introduction to electrical engineering (20 h)
  - Introduction to technical communications (80 h)
- Technical education (e.g. industrial mechanic, 2nd year of training):
  - Manufacturing and testing engineering (80 h)
  - Materials engineering (40 h)
  - Machine and device engineering (20 h)
  - Electrical engineering (20 h)
  - Control engineering (40 h)
  - Technical communications (60 h)

A mechanical engineer's (academically trained in higher/university education) task is to develop and construct machines. The task of a skilled worker (vocationally trained in the VET system), on the other hand, is to operate, maintain or repair machines. This demand manifests itself in the areas of learning structured framework curriculum of 2004 (Table 32.4), not in the above old curriculum following the scientific principle.

The following and final section will attempt to explain how this guideline can help design vocational education in the classroom. Here the framework curricula provide little support – and for good reason.

32.4 Pedagogical Foundations and Work-Process Orientation

As a first step, statutory regulations for the pedagogical foundations in the classroom will be presented. Here it becomes apparent that the teachers are only given a general framework as an orientation for their teaching with pedagogical foundations, rough descriptions of areas of learning as well as approximate time scales (study hours). According to the new concept, the framework curricula no longer contain concrete methodological teaching notes. In a second step, starting from the analysis of vocational and professional working processes, it should be demonstrated how a teacher can design the vocational education at a vocational school.

32.4.1 Pedagogical Foundations

Since 1991, it has been the objective of vocational education and training to provide trainees with the skills to autonomously plan, implement and assess work tasks in the context of their vocation (KMK 1991). This goal already existed, previously indicated, at the beginning of the twentieth century with the orientation towards the master craftsman. In the introduction of Taylorist working forms and the growth in industrial importance, the model example of the education moved towards the subservient employed worker. Since 1991, the aim has once more become to promote autonomy, independent of whether a person is employed or not. Such an aim requires education that promotes autonomy. The framework curricula do not name any concrete teaching methods or how such education should be implemented, but in each framework curriculum's introduction, the following points are mentioned for orientation in standardised form.

- Pedagogical points of reference are situations that are important for carrying out the vocation (learning for action).
- The learning basis comprises actions, ideally performed oneself or at least mentally comprehended and understood (learning by doing).
- Actions must be planned, implemented, monitored, where necessary corrected, and ultimately assessed by the learner, preferably autonomously.
- Actions should promote a holistic understanding of the professional reality, e.g. contain technical, safety-related, economic, legal, environmental or social aspects.

- Actions should be integrated with the learners' experiences and should reflect their social impact.
- Actions should also include social processes, for instance, declarations of interest or conflict resolution.

Apart from these orientation points, the education is now only framed by the provision of a brief description of the areas of learning with keywords on the contents. Area of Learning no. 13, 'Ensuring the operation of automated systems', of the framework curriculum shown above, the extent of such a description will briefly be illustrated (Table 32.5).

Above, reference was made to the teachers following the old paradigm of scientific orientation as subservient. Under the new paradigm of work orientation aimed at promoting autonomy, a change took place in basic attitudes: only teachers who can work autonomously can provide a framework within their education which enables pupils to learn autonomy. It would be a considerable contradiction in the concept if the teachers required their pupils to be autonomous, while simultaneously behaving subservient in their own actions. There are also other important points that speak for removing teaching regulations. How can differentiated education be promoted when an educational method has already been prescribed?

Table 32.5 Exemplary area of learning description

Vocation: Industrial mechanic		
Area of learning no. 3	Ensuring the operation of automated systems	3rd year of training
		Approximate time scale: 80 h
Formulation of aim:		
Pupils ensure the operation of automated systems. For this they analyse automated systems by using technical documentation, also available in English		
With consideration of the prescribed procedure and the manufacturer's documentation, they develop solutions for process optimisation of individual subsystems		
In order to repair operating faults, they develop strategies to isolate faults, apply them and then eliminate the fault with due consideration for economic aspects		
The pupils modify systems and test, document and present their solutions. They pay attention to the necessary steps for vocational safety when dealing with manufacturing and handling systems		
They assess the economic and societal aspects of automation engineering		
Content		
Electropneumatic and electrohydraulic functional units		
Control		
Regulation		
Programmable controls		
Operating modes		
Sequential function chart, function block diagram		
Flexible handling systems		
Interfaces		
Maintenance regulations		
Safety equipment		

How could holistic actions in class (planning, implementation and assessment) be initiated, if education were divided into small methodological substeps? And finally, how should pupils learn about participating in shaping their environment, if the teacher already prescribes the entire layout beforehand, as this in turn was given to him?

32.4.2 Work-Process and Business-Process Orientation

The book 'The Machine That Changed the World' first appeared in 1991 in German, and by the year 1994, the 8th edition was already published (Womack et al. 1994). The concept of 'lean management' was prevalent, and German companies and administrations were endeavoured to implement it. The new concept of areas of learning was developed at that time (1992–1995), and the responsible commission was made up of 'pragmatists', not of scientists. One would assume that these pragmatists were aware of the new concept. A key element of lean management was the orientation towards processes and turning away from functions. The areas of learning embodied the same development: an orientation towards working and business processes and turning away from subjects and functionalism. The traditional academic disciplines lost influence through this orientation. A new academic discipline in Germany called 'vocational sciences' (Howe and Knutzen 2011a, b) was attempting to fill the resulting gap. Their objective was to decipher the 'work process knowledge' incorporated in skilled work (Fischer 2000) in order to create the foundational content for the design of teaching/learning arrangements in the classroom in vocational schools.

Whenever a work process demonstrates a particular quality from a company's perspective, in other words, it shapes the company's profile (and for whose services the customer is paying), it becomes a business process. Support processes, on the other hand, provide the foundation for these business processes. Whether a work process constitutes a business process and therefore provides a use value depends on the reference: information technology, for instance, is a support process for a university and a business process for an IT provider. A requirement of vocational education and training is that the apprenticeship involves important and contextualised work processes. This requirement is embodied by the term 'business process'. An area of learning is by definition the didactically processed equivalent of a vocational sphere of activity, structured using business and work processes.

The above description of an area of learning (area of learning no. 13 for the industrial mechanic vocation) reveals that concrete work process steps are not listed. If teachers want to teach an area of learning in class, they must investigate the work process in the company for themselves (or in conjunction with other teachers or the students) in order to develop the area of learning.

In conclusion, the instrument of work process analysis is to be presented, because it embodies the work-oriented turn in vocational education and training on the one hand and on the other represents an instrument that enables the preparation of voca-

tional education based on areas of learning in the context of this turn. A comprehensive demonstration on the entire process with supporting work materials is documented in the 'Kompetenzwerkstatt' series with a total of 10 volumes developed by Falk Howe and Sönke Knutzen between 2011 and 2015 (overall concept: Howe and Knutzen 2011c) and published by the Federal Institute for Vocational Training (BIBB).

Starting point is that the areas of learning as an intermediate reference are given in the KMK framework curriculum. What is missing in the KMK framework curriculum is on the one hand the vocational spheres of activity (relation to work) and on the other hand the learning situations (relation to classroom teaching). With the instruments of the vocational sciences (macro-level, sector analysis; meso-level, case studies; micro-level, on-site visits, interviews and workshops), the work process knowledge has been explored. The connection between the workplace and classroom teaching has, linking to this preliminary work, the following rough stages:

1. Identification of vocational spheres of activity:
   - Work processes are demonstrated systematically in form of a work process matrix using data from on-site observations as well as interviews with experts from various representative companies. Within a work process matrix, the work process is split into four stages: order clarification, planning, implementation and completion. Every stage is specified using five dimensions: (1) laws, regulations, standards, (2) company conditions and rules, (3) customer requirements, (4) work steps and methods and (5) work objects.
   - Work processes that feature a logical connection are clustered together: the work process matrices are integrated. Previous research has shown that a job typically comprises between 12 and 15 of such clusters. A cluster may contain many less-extensive or few extensive work processes. Each cluster forms a vocational sphere of activity.
   - Parallel to the previous steps or following these two steps, moderated workshops lend themselves to better group these work processes into vocational and professional action sphere by providing different perspectives or to subsequently validate the resulting vocational sphere of activity in communication.
   - A description is drawn up for each vocational sphere of activity that comprises the following aspects: (1) typical orders; (2) typical work flow (work process steps); (3) curriculum, reference to the existing KMK framework curriculum; (4) vocational competence needed with two dimensions: (4a) work process phases (order clarification, planning, implementation, completion) and (4b) required competence to act in each phase (with the sub-dimensions technical, methodical, social-personal competence); and (5) trends in the vocational sphere of activity.
2. Planning and implementing learning situations for school-based vocational education

The next step comprises developing as a teacher team a vocational learning situation for the classroom using the information available (vocational sphere of activity with reference to the framework curriculum). This stage comprises the following steps (according to Berben 2006, p. 372 ff.; see also Bader and Schäfer 1998; Kremer and Sloane 2001; Howe and Knutzen 2011c):

- Analyse areas of learning: Which key goals are formulated in the area of learning (framework curriculum)? Which vocational and cross-vocational thematic areas do the area of learning focus on? What relationship can be seen between the area of learning and the vocational sphere of activity?
- Specifying a vocational sphere of activity for class: Which work process steps or rather work process stages should the learning situation's focal areas fall on? Which working tools and methods and which elements of the vocational competence to act are important to the learning situation within the area of learning?
- Description of task and learning situation: Which task is exemplary and relevant for the underlying vocational sphere of activity? Is the task suitable to the developmental level of the learner in terms of complexity, requirements and scope? Does the task allow for various solution possibilities? Can the task be carried out at school? What is the wording of the task for the students?
- Specify the key promotional areas: In concrete terms, what are the focal areas for competence building within the learning situations? What is the key content to be processed within the task set?
- Establish the required resources for the learning situation: What kind of environment is required for implementation of the learning situation? Which key subject matter is required for the learning situation?
- Clarifying the necessary conditions for learning and determining the amount teaching required: Which competences are needed to tackle the task and what competences do the students already possess? Can the gap be closed through self-organised learning or do supplementary subject-oriented educational units need to be planned in? When are these subject-oriented educational units to be implemented in concrete terms?
- Implement the learning situation and supporting reflection on acquired experiences: How, when and who presents a customer order? How can all the phases of the learning activity (order clarification, planning, implementation and completion) be accompanied supportively? How can the social learning processes be supported through the teacher's actions? How can reflection be initiated in the learning process and when should these reflection phases be planned in?
- Concluding reflection and systematisation of the acquired knowledge: How can the acquired knowledge be linked and structured into a systematic relationship? Are overarching (economic, environmental, social) implications also included in the reflection? How can the knowledge gained be transferred to other situations and what modifications would be required in this case?
- Assessment of learning achievement: What competences did the students develop within this learning situation (with separate evaluations of technical, social and personal competences on the one hand as well as their expression in terms of

communicative competence, methodological competence and learning competence on the other).

The reduction in statutory provisions in the framework curriculum creates space for didactic decisions in the classroom. However, these activity spaces must now be filled by the teachers and students, posing a large challenge for both sides. After the new concept was introduced, the slogan 'from a thematic to a process supporter' started becoming popular. However, this is an erroneous description of the situation – but it did provide an accurate representation that the role model had enriched. The teacher must remain the technical expert. In open, interactive situations, this may not and does not always have to be the case, however. The role extension therefore had an emotional dimension: being able to accept that a teacher does not always know all the answers beforehand, but may have to work at getting to the answer, where necessary, in class together with the students. The role extension also had a methodical dimension: besides the technical competence of design of the classroom in terms of content, now there is also the competence to moderate the discussion and learning process. These added requirements gave some teachers difficulties. Forms of resistance ranged from overt rejection of the new areas of learning to covert refusal by simply renaming old subjects into areas of learning, but maintaining the old form and content of the previous education system. Today, more than 20 years after the reform, the resistance has decreased considerably or completely disappeared. As to the extent of covert refusal or 'internal resignation', it is unclear how much of this still remains. No comprehensive studies have been published on this matter. It is to be expected, however, that forms of this type of resistance still exist.

32.5 Conclusions

Since the introduction of the areas of learning concept, a significant change took place in the school-based part of the dual system that led to the work-oriented turn. The new framework curricula are designed to orient areas of learning in school above all according to vocational spheres of activity. This reorientation means the distinction between 'theory = school' and 'practice = company' loses significance. Due to the Federal Republic of Germany's federal structure and the shared jurisdiction of federal government (responsible for vocational training) and state government (responsible for school-based education), there continue to be two regulations (training regulations and framework curriculum), and, although they have been coordinated with one another since 1972, they are still governed by different authorities and therefore demonstrate differences. Perhaps these differences prevent school education from economisation and protect humanist values? Perhaps an integrated education and training regulation improve the overall quality of vocational education and training? As this has as yet not been implemented, possible consequences and side effects are unclear. The development since 1990 does, however, show that on the whole, not only has school-based vocational education and training

moved closer to work but also that the vocational side has achieved an important educational objective by providing trainees with the skills to autonomously plan, implement and assess work tasks in the context of their vocation.

Crucial to all these questions is the used concept of competence: defining expectations in terms of outcomes has a lasting and structural-educational effect on training in companies and education in schools.

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Chapter 33
Knowledge Concepts in Competence-based VET Research Perspectives on Cognitivist and Social-Constructivist Approaches

Agnes Dietzen

33.1 Introduction

As a result of large-scale international assessments such as PISA, TIMSS and PIAAK, one of the main streams of empirical educational research focuses on competence diagnostics. Within this context, competencies are defined as 'acquired cognitive dispositions of performance that functionally refer to situations and requirements in particular domains' (Klieme and Leutner 2006, p. 879). The definition stems from Weinert's influential assessment of the definition and selection of competence for international school performance studies from 1999. After weighing the various theoretical standpoints and empirical findings in cognitive and developmental psychology, Weinert suggested defining 'competence as functionally determined cognitive achievement dispositions related to certain classes of situations and requirements that can be described psychologically as knowledge, skills, strategies, routines as domain-specific abilities' (Weinert 1999). This definition encompasses a limitation to cognitive dispositions, although Weinert elsewhere states that he regards motivational, volitional and social willingness and the ability to take successful and responsible action and solve problems as fundamental (Weinert 2001, pp. 27). For pragmatic research reasons, performance studies have focused on the examination of cognitive performance dispositions, while motivational, volitional and emotional aspects have been marginalised and always examined separately.

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Although this focus on cognitive aspects is widely accepted within empirical educational research in general and higher education, critics see its limitations particularly in domains addressing more complex skills and competencies, e.g. intercultural competencies (Köller 2008) and diagnostic competencies of teachers (Hansmann et al. 2013). The critics point out the exclusion of motivational and volitional aspects of performance within these domains, which they believe lead to inappropriate competence models. Köller sees a need for further research on modelling of complex competencies, e.g. for cultural and social science subjects in schools. Martens and Asbrand (2009) recommend a praxeologically oriented, theoretical approach to reconstructing action competence and the conditions of their acquisition for competence domains such as historical thinking or global skills for learning. This approach is based on the insight that action competence within a certain domain consists primarily of tacit knowledge and social practice skills, which are far more fundamental for understanding human social conduct and competence than the action and cognitivist theorists hypothesise for individuals and rational actions. Complex skills and competencies are therefore not sufficiently empirically accessible by means of quantitative tests and assessments. Instead the authors propose supplementary reconstructive qualitative social research strategies such as the documentary method (Bohnsack 2007).

The perceived growing importance of national and international performance surveys in the field of general education has also led to the development of approaches for measuring competence in the vocational education sector, and empirical modelling methods are available for a number of occupations, in particular for subject-related occupational competence. In terms of research methodology, these approaches build directly on the concept of psychological-cognitivist-oriented action competence (Klieme and Hartig 2007, p. 21). Competence is defined as a combination of knowledge, abilities, skills and attitudes in conjunction with a specific action context or action situation.

For a number of diagnostic competence research approaches, this understanding of competence is compatible with the concept of occupational action competence, which has roots in both education theory and action theory traditions (Achtenhagen and Baethge 2007; Brand et al. 2005). In vocational education and training in Germany, the term competence is traditionally against the backdrop of education theories including pedagogical anthropology from Roth, associated with ‘maturity as expressed in (a) self-competence, ie the ability to act in a self-responsible manner (b) professional competence, ie the ability to make good judgments and take action in professional fields and thus to assume responsibility and (c) social competence, the ability to make good judgments, take action and thus also to assume responsibility’ (Roth 1971, p. 180). In addition to cognitive dispositions, affective-motivational aspects of a comprehensive ability to act are fundamental for this definition as well as for further definitions of competence based upon it (Reetz 1989). A holistic understanding of competence as an integrated combination of professional, social, personal and, according to some competence models, also methodological competence has been established for schools as a site of learning in dual education and training since the 1990s.

Over time, the implementation of such a holistic understanding of occupational action competence has given rise to a number of challenges from both a didactic (Dilger and Sloane 2012; Wesselink 2010) and a testing perspective as well as in particular from the standpoint of scientific competence measurement (Nickolaus and Seeber 2013).

Academics from the field of cognitive-psychologically oriented occupational training research regard assessment of a holistic concept of occupational action competence as being implausible due to reliability and validity issues (Nickolaus and Seeber 2013, pp. 170). Instead, they pursue a strategy of developing separate competence models and measuring instruments for the individual sub-dimensions of professional competence as well as for social-communicative and personal attitudes and abilities, the interplay of which is then to be successively tested in requirement-based occupational actions. The research initiative ASCOT (2012) (technology-based assessment of skills and competence in VET) pursues this approach to solving diagnostic problems. The initial pilot schemes aim to develop methodologies for measuring professional action competence which could then have a broader application in large-scale assessments. The underlying theoretical concept of competence is that of Weinert as 'acquired cognitive dispositions of performance'. The projects largely follow the suggestion of examining motivational and volitional aspects separately and focused on modelling and measuring professional competencies, based on the assumption that professional expertise is crucial to occupational action. Individual projects are also devoted to the development of competence models for social-communicative competence. Initial experience has already been gathered in work on modelling of social-communicative competence in the medical field using video-based test procedures (Dietzen et al. 2012; Dietzen et al. 2015) as well as modelling of consulting competence in bank clerks (Tschöpe 2015).

Only a handful of test procedures that seek to address all dimensions of occupational action competence (self-competence, professional competence, social-communicative competence) in equal measure have been developed (Rauner 2010), and they are criticised for their inability to produce either reliable or valid competence assessments (Gschwendtner et al. 2009). The other way around, holistic testing procedures regard the pragmatic approach of examining social and personality-based abilities separately as being critically deficient because social and personality-based abilities cannot be separated from competent execution of occupational tasks. Consequently, they believe measurements of competence in the individual dimensions are not meaningful (Fischer 2012).

In addition to this line of conflict between holistic assessment of occupational action competence and an analytical, differentiated assessment of sub-competencies, an additional line of conflict exists in regard to the definition of cognitive dispositions and the knowledge concepts on which they are based in occupational action situations (Dietzen 2011, 2015). In identifying the relevant knowledge structures for occupational actions, cognitive psychology approaches draw on action regulation theories (Hacker 1998, 2003) to operationalise the individual steps from perception, interpretation, evaluation and situations (orientation) all the way to realisation and

implementation in action (application ability) and to model the knowledge basis necessary for this purpose. This presumes action knowledge that encompasses the ability to gradually change professional situations both in thought and in reality, transforming an actual status into a target status. It becomes effective in problem-solving as well as in the regulation of practical action. These activities incorporate both cognitive performance and affective and volitional aspects (Brand et al. 2005).

While this current mainstream empirical research is connected to the psychological-cognitivist tradition of competence research, the key critics in VET argue from a different conceptual perspective, which is proposed from a social-constructive theoretical view. Knowledge, skills and experiences are regarded as embedded in social practice in this viewpoint. The components of competencies (dispositions) are intrinsically tied to the social and practical contexts of work. This viewpoint is represented by VET research scientists, who postulate a 'practical knowledge type' that is fundamental and identity-forming for VET. This includes conceptual studies on 'work process knowledge' and studies that reference theories of situated learning, the importance of communities of practice (Lave and Wenger 1991) as well as studies with practice-theoretical references (Rauner 2007).

Fundamental lines of argumentation regarding these different perspectives of the relationship between knowledge, knowing (skills) and action are crystallised in a debate in a German-language journal for vocational and business education, *Zeitschrift für Berufs-und Wirtschaftspädagogik* (*ZBW*) (1998, 2007, 2013). The debate arouse on establishing a tacit knowing perspective by Neuweg (1998, 2007) following the epistemology by Polanyi (1958, 1985). In recourse to Ryle, Neuweg's thesis philosophically set forth that 'knowing' over considerable distances cannot be understood or not understood exclusively as knowledge explication, because competent exercising of a respective action practice is based primarily on implicit structures and processes that are not accessible for external observation. Kreitz (2007) claims that practical action knowledge is indeed dependent on the conveying of theoretical knowledge. Minnameier (2007), on the other hand, assumed a mediatory position, calling for the exploration of boundaries between explicit and implicit forms of action and the accompanying acquisition of competence. Lempert (2007) sees the tacit knowing view as compatible with the practice-sociological approach of Bourdieu, and Nickolaus (2013) gave an overview on the different positions in the debate.

In light of these lines of discourse and centrally positioned arguments, this chapter examines occupational action knowledge in its various forms and the possibilities for empirical assessment. In particular, it addresses the question of how the relationship between implicit and explicit forms of knowledge is developed in the concept of action knowledge in the various approaches and what the resulting consequences are for empirical assessment of action knowledge

Firstly, a preliminary discourse on the role of knowledge in supporting learning and training of practical skills and action competence from a didactic perspective will be outlined.

Secondly, central assumptions of a social-constructive perspective on competence are made. They refer to a tacit knowing perspective and the associated critique of the cognitivist paradigm in teaching and learning theory, as propounded in the German-language vocational pedagogy debate by Neuweg (2001, 2005a).

Thirdly, and by way of contrast, central assumptions of a cognitive-based concept on competence and linked theories on action regulation and social cognition in respect to the resulting conditions for competence assessment are then being discussed.

Fourthly, the chapter poses the question whether these conceptual approaches are convergent or divergent. Arguments on divergence emphasise the different epistemological backgrounds, while arguments on convergence tend to accept both the important roles of tacit and systematically acquired knowledge within processes of problem-solving and competent social action. They propose to better differentiate contexts and situations of actions in order to understand, reconstruct and explain processes of knowing and competent performances.

33.2 Preliminary Discourse Regarding Knowledge Concepts in VET

The question of what knowledge the development of occupational action ability (Berufliche Handlungsfähigkeit) is based on and should be conveyed in teaching and learning situations was discussed in a debate on didactic design in German VET in the 1990s. The starting point was the introduction of the concept of 'occupational ability to act' as the objective of initial vocational education and training. On the company side of dual training, training methods and subsequently regulatory instruments were aligned to the principle of the 'holistic action processes'. On the vocational school side, the term 'competence' was firmly established in the curricula when the concept of the learning field was introduced in 1996. This constituted the abandonment of the principle of separate subjects at vocational schools in favour of orientation towards occupational tasks and problem-solving assignments. The most important change associated with the learning field approach was a move away from technical systematics as a starting and reference point for curriculum decisions related to content. Instead, the idea was that learning fields should be conceived as intentional and thematic units constructed on the basis of task assignments and action processes and taught in a cross-cutting or subject-integrative manner (Tramm 2003, p. 9).

This implementation of occupational action competence as the training mandate of vocational schools (KMK 1996) meant that at the heart of a training debate conducted along vocational pedagogy lines lays the question of how teaching and learning processes need to be structured in order to support the acquisition and empirical recording of such competence. Differences in positions adopted are

revealed in the relevance of various knowledge concepts and subsequent teaching and learning arrangements.

In broad terms, the varying positions were located within an area of conflict that is between systematic subject-based learning on the one hand and casuistic learning on the other. The proponents of casuistic learning question the basic assumption that institutionalised teaching and learning situations communicate knowledge which is subsequently converted into practical and competent action by learners. Within this context, the main driving force behind demands for a work process-related reorganisation of vocational training came from a Bremen-based research group headed by Rauner (1995). The construct of work process knowledge played an important part in this development. Fischer (2000) defines work process knowledge as knowledge that is directly acquired and required within the work process.

According to this position, work process knowledge encompasses the essential dimensions of a practical type of action that in conceptual terms extends well beyond the understanding of practical action as the result of theoretical knowledge previously acquired. The latter implies a deterministic perspective of learning and the acquisition of experience and a simultaneous neglecting of the societal forming of technical facts and circumstances. By way of contrast, the significance of technical learning contents for the process of occupational competence development is greatly overestimated. Such contents usually affect at most a few aspects of the work-related fields of significance (Rauner 2007, p. 68).

By the same token, if alignment towards current practical occupational knowledge is too narrow, there is a perceived danger that systematic knowledge is inadequately communicated. This means that important cognitive orientation functions cannot be provided. The latter applies both with regard to the systemic environment in which the individual task areas are embedded and in respect to the structure and dynamism of the relevant technological fields of knowledge. Referencing curricular development solely to existing occupational action situations is also viewed as unsatisfactory, not least because of the high level of dynamic change in company practice and poor company-based training conditions in some cases.

This debate has revealed a fundamental requirement for clarification as to which forms of knowledge need to be addressed in vocational education and training in order to develop professional performance. In contrast to the general education sector, competencies for particular activities which are primarily of a practical occupational nature and which provide orientation are necessary for the development of employability skills rather than merely cognitive abilities related to the contents of school-based subjects (Brand, p. 6). In relation to research, the focus is on differentiation of the categories of knowledge with regard to their applicability and therefore on a conceptual identification of practical action-related knowledge. The relevance of various knowledge constructs and their contributions towards the development of professional competence and skills as expounded in the discussion surrounding learning fields find expanded references in the new area of occupational competence research.

Current approaches to creating an action theoretical base for competence research and measurement assume an interlinking of both knowledge in various forms as

well as skills, attitudes and other regulatory components such as metacognitive strategies in situation-based realisation in competent action. In vocational education discourse, competence is therefore also understood as the linking of knowledge and ability in the mastery of action requirements (Klieme and Hartig 2007, p. 19).

33.3 Knowledge, Knowing and Action in a Social-Constructive Perspective

For the purpose of discussing a social-constructive perspective, the following remarks will refer to the 'tacit knowing view', which acts as a 'conglomerate of family-like core principles' and in particular goes back to the Personal Knowledge Theory of Michael Polanyi and to the term 'tacit knowing', popularised by him, and forms an action and learning theory style of thinking (Neuweg 2005a). In the German-speaking world, reception and diffusion largely takes place via the term implicit knowledge. The concept has in particular been made accessible to vocational education and training research via vocational pedagogy reception (Fischer 2000, Neuweg 2001, 2005b), via sociology of work approaches (Böhle 2005, 2009, 2015) and via adaptive expertise research (Gruber et al. 2008). In the English-speaking world, the concept is being picked up and developed further within the context of various studies of 'workplace learning' (Billett et al. 2008, Billett et al. 2006) and in studies relating to the development of practical knowledge and professional (occupational) competence (Eraut 2000, 2004, 2007). The approach of competence as 'situated professionalism' shares many aspects with such a social-constructive view (Mulder 2014). It emphasises the development of competence during experience with certain activities in certain contexts. And it focuses on the idea that knowledge is situated being in part a product of the activity, context and culture in which it is developed and used (Brown et al.1989, p.32). The aspect of professional identity formation is also important for that approach (Mulder 2014, pp. 129).

The thesis that knowledge and skills cannot be fully explained goes back to Polanyi and is fundamental to the tacit knowing approach. Knowledge and skills prerequisites are not fully explicable because of a basic dual alignment of attentiveness in perception, action and recognition processes. This is revealed in subsidiary awareness and focal awareness. In perception, recognition and action, the elements of subsidiary awareness merge with those of focal awareness. Although these elements continue to be implicitly available, they cannot be explicitly identified in a simple manner without loss of the correlation between perception, recognition and action. Polanyi uses the term tacit knowledge for this subsidiary structure and delineates this analytically from the term explicit knowledge, which is the knowledge within the focal awareness. In contrast to tacit knowledge or implicit knowledge (both terms are often used synonymously in research literature and below), explicit knowledge can be articulated and archived.

Although many aspects of research refer to these conceptions of implicit and explicit knowledge, for Neuweg the focus of the tacit knowing approach is less on the analysis of forms and structures of knowledge or on the determination of the proportions of explicit and implicit knowledge on the part of a person or an organisation. Instead the focus is on the processes of perception, evaluation, anticipation, thought, decision and action and on an analysis of the prerequisites for such processes (perception and action dispositions) on 'knowing' and on 'connoisseurship' (expertise) (Neuweg 2005a, p. 557). How performance emerges from knowledge resources and perception and action dispositions remains fundamentally concealed from the acting and recognising individual and from the external observer. 'Knowing' can only be perceived and investigated in the form of perception, recognition and action practice in relation to its articulable equivalences as rules, descriptions and instructions (Neuweg 2005a, pp. 557–558). As a consequence, the relationship between knowledge, knowing and action cannot simply be represented in the form of cause and effect nor can it necessarily be viewed as consecutive in the tacit knowing approach.

This view goes back to G. Ryle's criticism of the empiricist paradigm, adopted via Polanyi in Neuweg (Neuweg 2005a, p. 558). Ryle disputed that a certain ability is preceded by application of rules for action guidance, whether consciously or unconsciously. Instead, the descriptions of perception, action and thought were based on attributions of knowledge by the observer and thus became statements on the 'knowing how' of a first person, which Ryle regarded as a category error (Neuweg 1998, pp. 2). The fallacy consists in attributing the performance of an individual person as the 'epiphenomenon of inner mental structures'.

So cognitive dispositions and inner planning conduct are not always sufficient or necessary conditions of meaningful action. By the same token, there are many actions which we characterise as being intelligent, aware and flexible but for which no prior cognitions can be identified. Nor does action-related explicit knowledge necessarily need to be condensed into relevant judgment or action competence, something which is extremely well demonstrated on the basis of experimental psychological studies that provide evidence of systematically occurring disassociations between explicit knowledge and performance. One term that has become well known within this context is 'inert knowledge' (Gruber and Renkl 2000). This illustrates that the acquisition of comprehensive theoretical knowledge does not automatically put a person in a position to solve complex problems related to reality and that such knowledge cannot be translated into effective action.

According to Neuweg (1998, p.15), descriptions of rules can be useful in reconstructing and explaining performances but cannot serve as theories of explicit knowledge. Reconstructive explanations can be used for the purpose of describing learning goals in teaching content, but are not suited for guiding learning processes.

Tacit knowing, particularly in the form of knowledge that is fundamentally inexplicable and cannot be encoded, thus (1) sets clear limits to attempts at didactics, (2) emphasises the indispensable role of a person's own action experiences in the establishment of competence and (3) supports the idea of learning in the workplace as

well as the high degree of significance of personal contacts between the holders and recipients of the implicit knowledge.

Where rules are absent or show themselves not to be sufficiently generative, the tacit knowing approach indicates learning within the functional field or in quasi-functional learning environments and in particular refers to learning via socialisation processes in expert cultures and/or in relationships between masters and pupils. Research into communities of practice (Brown et al. 1989; Lave and Wenger 1991) also provides evidence that such communities are characterised by styles of thought and paradigms, practice rules and report back on rule infringements without any requirement for these basic principles that are necessary to orientation to be codified.

Neuweg believes that this paves the way for a type of action that is strongly centred on forms of action regulation which exhibit both an intuitive character and a high level of flexibility and in which the attention performances of the actor are directed at the situation or tasks rather than at his or her own cognitions.

On the basis of the insight that explicit knowledge and rational planning are a vehicle for still further generation of principles for flexible and skilled practice, Neuweg arrives at the conclusion that action itself needs once again to be made the starting point for psycho-actional theories. To sum up, we can therefore state that, with regard to the knowledge-knowing problem, the tacit knowing approach is led by the conviction that knowledge does not fully touch practice either in descriptive or instructive terms.

The fact that a large part of knowledge is implicit, tacit and cannot be verbalised nurtures far-reaching research methodological doubts that surveying procedures can uncover the knowledge basis of expert action. Neuweg believes that the consequence of the obviously broken relationship between verbalisation and action expertise is that performance is ultimately the only appropriate indicator of skill and must therefore also be the crucial starting point for competence diagnosis measures (Neuweg 2005b, p. 583).

33.4 Knowledge, Knowing and (Social) Action Within the Cognitive Perspective

The understanding of competence outlined at the start is decisive for the relationship between knowing, ability and action in occupational competence research.

While cognitive performance is defined by contents of curricular structures (school subjects) in the general educational sector, and certain tasks and problem must be embedded in order to permit empirical assessment, the problem presents itself from another angle in the VET sector. The starting point here is practice, usually easily identifiable through occupational fields of action and problem situations. The problem here is identifying cognitive performance and the relevant knowledge basis for it (Brand et. al. 2005). The focal point is the question which limited element

and regulatory system (knowledge basis) can be used to generate a principally infinite number of actions adequate to a situation. 'The path of clarification here thus leads from the occupational situation over the performance required to the knowledge that must be activated in the performance' (Brand et. al. 2005, p. 7).

Action regulation theories that build on Hacker (2003) and Volpert (1983) play a central role in modelling the relationship between knowledge and action in the current discourse on competence. Ideally, actions take place within the framework of a rational process guided by knowledge that is shaped primarily through the sequence of (1) situation-based goal setting and the intention to carry out action, (2) orientation to action options and tapping of the knowledge necessary for them, (3) rational planning of an action and development of alternative action scenarios, (4) decision for an action alternative that appears advantageous, (5) implementation of it and (6) reflection on optimisation possibilities. This process also serves as the basis for many of the currently preferred didactic settings.

For Hacker, the most important characteristic of action regulation is that actions are controlled by goals, and these goals are seen from a cognitive perspective as anticipations of the results that individuals intend to achieve. From a motivational perspective, these goals can also be seen as intentions. Until the action has been completed, the goals that regulate the activities are stored in memory as a representation for what the final result should look like. Hacker also regards these goals as the starting points of the emotions that are inherently associated with our actions, e.g. perceptions of success or flow (Hacker 2003, p. 108). He distinguishes three levels or modi of mental regulations: an automated/automatic level (kinaesthetic cues, implicit knowledge), an optionally consciously controlled level (perceptions of situational cues, explicit knowledge) and a necessarily consciously controlled level (intellectual analysis of situation, explicit knowledge) (Hacker 2003, p. 108).

Cognitive competence research approaches often assume the existence of two cognitive systems: a (dominant) associative system that easily makes connections between perceived requirements and existing behavioural and action possibilities and a conscious and a more laborious system that offers us the possibility to act in a conscious, target-oriented and carefully considered manner (Kahnemann 2011).

Social cognition approaches (for an overview, see Schützeichel 2007), which play an important role in particular for competence modelling of occupational and professional tasks and activities with socio-communicative requirements, also propose various cognitive models based on more or less explicitly conscious or implicitly effective knowledge structures. These are used for perception of states as well as classification of situations, contexts and persons. They help to reduce complexity insofar as they emphasise certain aspects of perception and meaning while at the same time blocking out other aspects. In theories of social cognition, various knowledge structures usually activated as tacit knowledge are distinguished as schemata, categories, prototypes, stereotypes, scripts or cognitive maps. They contain general expectations and knowledge content regarding situations, states, person, spatial scenarios, action sequences and events. All these forms of cognitive representations are closely linked with one another and are regarded as sub-elements of cognitive-associative networks. Generally speaking they facilitate information processing by

associatively integrating new information into existing preliminary knowledge or by calling on preliminary knowledge to help take in new information, reviewing this new information for expansion of the knowledge base. These types of processes can take place automatically and are attributable to tacit knowing, or they can take place in a controlled manner and are thus characterised by the active search for the solution to a certain problem, thereby requiring a great deal of attention and therefore conscious awareness. In social cognition approaches, judgment heuristics play an important role as well. They help individuals assess behaviour and action by other persons. Often they are 'rules of thumb' that people remember because they have proven useful in the past, but which can also systematically distort new information in new situations (Kahneman et al. 1972). Research on heuristics is characterised by the central assumption that they do not arise from specific motives and interests of the persons involved and thus can also lead to erroneous conclusions and distortions but instead arise from individuals' varying ability to find appropriate strategies for making judgments and decisions.

In research approaches to social competence, action regulation processes are linked with theories of social cognition. Drawing on Hacker, Kanning (2009), for instance, sees a completely rational regulation process taking place in an ideal typical manner in social situations. According to Kanning, the steps for situational interpretation, analysis of behavioural options and systematic consideration of action alternatives contained therein are very abbreviated or more or less excluded. In particular in familiar situations, internalised perception, judgment and action schemata make possible abbreviated action regulation and permit implicit control of subactions (Kanning 2009).

This is especially clear in the work of Hacker, who has in the past several years focused strongly on psychological action regulation of dialogue-interactive activities and has pointed out that a distinction must be made between various components that can or must be consciously perceived for these types of activities as well. Examples are personal or customer typologies that represent such schemata. They are established in early phases of social interaction and facilitate selection perception and interpretation of social signs (Tschöpe 2015).

Additional examples for interpretation of implicit knowledge in current action and competence theories are action routines and their establishment. In the theory proposed by Ackerman (1992), an ability is acquired in three characteristic phases: a cognitive phase in which execution of the action requires conscious control and is usually not completed satisfactorily, an associative phase in which partial routines have already been established and attention can be deliberately devoted to optimisation and the automated phase in which execution of the action is largely controlled by practice-based schemata.

In these approaches, competent occupational action is based on the interplay of various cognitive dispositions requiring a varying degree of conscious awareness and that can therefore be located on a continuum of implicit and explicit available forms, each dependent on the situation and context.

From a tacit knowing view, forms of knowledge built on tacit knowledge remain limited to action routines and automated orientation and control functions in these

conceptual approaches and are thus still more or less cognitivist approaches on a logical level. In Böhle's work on experience knowledge (2015), for example, key elements of tacit knowledge, to which Polanyi refers and Neuweg builds on, are not taken into consideration in such a view of the relationship between tacit and explicit knowledge. For Polanyi, tacit knowledge is knowledge that cannot be easily explicated because it is based on certain perceptions and perceptive abilities. Böhle summarises these aspects in an action type that is based on sentient and forming and sensory perception and is oriented to characteristics and behaviours in concrete conditions that are not accessible to objectifying perception and are therefore ignored as information and sources of information in cognitivist approaches.

33.5 Conclusions

How sustainable are the differences between social-constructive-based and cognitive psychology-based approaches towards competence research with regard to the further development of a field of research that is still new?

What are the cognitive activities that must be carried out within the scope of competent application of knowledge? Is it possible to formulate requirements that learning must fulfil in order for the individual involved to be able to apply it (in a sensible manner) (Minnameier 2007, pp. 185–186)? These are the questions that arise in competence research from a reconstructive explanatory standpoint and are the starting point for Eraut's (2000, 2004) theoretical-empirical approaches for making tacit knowledge accessible for learning processes.

The question as to whether tacit knowledge can be made explicit requires clarification of what sort of tacit knowledge is involved, knowledge which is not communicated (such as the social rules and norms of a society or institution) or knowledge that cannot be communicated, such as the physical rules of balance when riding a bicycle. The problem for research is to explore the continuum of explicit forms of knowledge to implicit forms in order either to find a route and procedure for revealing tacit knowledge and making it communicable or else to obtain sufficient evidence of the existence of forms that are not accessible to external observation and recording them and then to include these limitations in an evaluation and assessment of the action situation.

Eraut (2000) enables identification of a series of situations and contexts in which tacit knowledge is acquired or in which it guides and structures occupational action.

- The acquisition of knowledge that takes place via informal learning and of which the learning individual is not aware.
- The acquisition of knowledge on the basis of experiences which are stored in the long-term memory and which lead to powers of judgment and decision-making ability.

– Implicit theories, personal constructs and schemata of acting persons which are of high significance in particular in the interactive field and which can be made accessible via external observers or recording.
– Knowledge and competencies that facilitate rapid, intuitive understanding and action.
– Knowledge and competencies that facilitate transferability of competence. Knowledge and competencies that are required and embedded in the everyday context encountered.

Attempts by Eraut and others to make tacit knowledge accessible in these contexts were and are subject to clear limitations. In learning contexts, the attempt is in fact unavoidable when it comes to improving learning processes and introducing reflection on learning situations. In addition, a certain degree of explicit clarification of tacit knowledge is essential in the context of competence assessment and competence measurement because it must be possible to identify the way in which occupational actions and learning results are linked. As Eraut makes clear, however, we must assume that there are significant limitations to the explicit clarification of tacit knowledge.

Ultimately, the tacit knowing perspective approaches presented above coincide with cognitivistically influenced competence research in the assessment that application of knowledge is strongly controlled by the tacitly available perception, thought and evaluation schemata and is therefore in large part a black box and that corresponding action explanations are only possible via descriptions that vary in the degree of explicit and tacit knowledge they contain.

Eraut states that, for this context, it is likely that thick tacit versions of action explanations and performance attributions coexist alongside thin tacit versions. The thick versions mainly have an important role to play in the acquisition of practical occupational proficiency, whereas the thin versions fulfil their function with regard to establishment, justification and transfer of knowledge and skills and for surveys (Eraut 2000, p. 135).

The lines of discourse mirror central arguments that are also found in the sociological discussion within the scope of a ‘practice turn’ (Schatzki et al. 2001; Reckwitz 2003). This critique is directed against various action theory approaches. In contrast, Bongaerts (2007) and in particular Schulz-Schaeffer (2008, 2010) attempt to link theories of practice with more recent action theory approaches.

Theorists of praxeological sociology argue that the concept of action should be replaced by the concept of embodied social practice. They hold that knowledge is incorporated in habitual individual and collective orientations in particular and that this tacit knowledge and skills of social practices are much more fundamental for understanding human social conduct than action theorist’s suppose for individual and rational actions.

With recourse to Ryle (1949, 2000), the theory of practice also emphasises that the explicit rules cited as relevant in a field of action must in no way satisfy these tacit criteria; they also underscore that knowledge does not chronologically proceed action as theoretical thought but should instead be regarded as a component of action

(Reckwitz 2003, p. 292). They believe that attributing actions to a meaningful orientation of the actors as conscious, intentional process represents a rationalist understanding and a conceptual intellectualisation of action (Reckwitz 2003, p. 320).

Intentionality and normativity appear in practice-theoretical approaches only in practical action knowledge. Action is therefore viewed more as a behaviour that is less dependent on individual goals and intentions and more on tacit knowledge and ability that are expressed in this behaviour. The meaning underlying an action is found in a tacitly mobilised situational 'know-how' as expressed in performance. Individual actions are guided by knowledge-dependent routine instead of intention. Practice-theory approaches therefore seek to reconstruct practical knowledge with the following elements in a field of action:

- Knowledge in the sense of interpretative understanding, i.e. routine allocation of meaning to objects, persons, abstract entities, one's own self, etc.
- Methodical knowledge, i.e. script-like procedures for competent execution of a series of actions
- Motivational-emotional knowledge, i.e. a tacit sense of what one actually seeks to accomplish, what it is all about and what would be 'unthinkable' (Reckwitz 2003, p. 292)

This embodied knowledge consists of perception, thought and evaluation schemata in which experience-based regularities in the natural and social world have habitually incorporated themselves. These habitual forms of knowledge play an important role both in the theory of practice and in many more recent action theories and are therefore not a unique characteristic of theories of practice. Instead, praxeological argumentation does not explain the question of how actors activate the silent knowledge and abilities that enable them to act. According to Schulz-Schaeffer (2010, pp. 332), what is fundamentally lacking is an analysis of the various degrees of tacit knowledge and its practical effectiveness in actions, such as suggested by Eraut (2000) on the basis of empirical studies.

According to Schulz-Schaeffer, the differentiation of various creation and activation contexts of tacit knowledge and abilities permits the development of criteria for corresponding thought and action schemata along a continuum of various degrees of tacit knowledge. This makes it possible not to play intentions and dispositions of actors out against each other, but to view them as augmenting each other to different degrees or as overlapping aspects of behavioural orientation (Schulz-Schaeffer 2010, p. 320). This requires a supplementary action theoretical approach such as frame selection from Esser (2001), which is designed to integrate both consciously created, selected and silently influential situational interpretations and action orientations in one theoretical framework. According to the model of frame selection, actors determine the subjective meaning of an action in various situations on the basis of interpretation patterns: on the basis of frames and of scripts. These frames are cognitive models of typical situations and serve to establish the frame of reference. Scripts are cognitive models of typical sequences, expedient and appropriate action within such a frame of reference (Esser 2001, p. 262). A frame is allocated to

a situation automatically and on the basis of previous experience. This situational definition is followed by script selection, which then provides a sequence of actions for implementation in action. Schulz-Schaeffer points out that the concept of frame selection poses the danger, rationalistically narrowed, of limiting forms of tacit knowledge and ability to expedient routines and therefore suggests further development. This development should take a differentiated look at both the more strongly intentionally shaped and explicitly accessible manifestations of tacit knowledge and ability and the more strong dispositionally acquired and anchored manifestations and examine them in terms of their effectiveness in actions.

These theoretical starting points are promising for competence research and cater to the demand in competence diagnostics for adequate explication of action situations which can be used as the basis for more closely examining the interplay of explicit and implicit forms of action control (Nickolaus 2013).

These theoretical approaches can be used in particular to model and measure complex occupational competence constructs such as social-communicative competence. In this still young focal point of research in occupational competence diagnostics, research-based approaches and tests that depict typical occupation action situations such as Situational Judgement Tests (Lievens and Chan 2010, pp. 347) have gained in popularity in the past 20 years. Test-takers indicate their fictional behaviour in the various typical occupational situations or assess the suitability of behavioural options in these situations. Like other examples from research into professions (e.g. diagnostic competence of teachers by Hansmann et al. 2013), they are grounded on a case-based research approach. In examples such as these, the objective is to identify the implicit perception, thought and action schemata that enable the actors to respond appropriately to practical requirements in unpredictable and variable social situations. The fundamental idea behind these tests is that the individual behaviour of the test-takers indicates the existence and strength of certain perception, thought and action schemata that can be regarded as valid predictors of future action.

In both the German-speaking community and internationally, there are too few role models of interpretive-explanatory approaches to competence modelling for reconstruction of action knowledge and competence acquisition processes. There is still a great need for development here. Such models could play a fundamental role in expanding the theoretical-conceptual basis of competence research that will lead to improved empirical approaches to assessment of occupational competence.

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Chapter 34
Competence and the Need for Transferable Skills

Christof Nägele and Barbara E. Stalder

34.1 Introduction

In Chap. 1 in this volume, professional competence is defined as a prerequisite for effective performance which consists of knowledge, skills and attitudes (Mulder et al. 2007). Just as the knowledge component in competence (see Chap. 33 of Dietzen in this volume), the skill component deserves separate attention. Like in the description of the construct of competence, there is wide variation in the definition of skills. Sometimes skills and competencies are being used interchangeably. Skills describe specific abilities that are developed directly in real-life situations or through education and training and later on transferred to the real-life situation.

This chapter will focus on transferable skills, since they are much sought after by employers. Transferable skills are skills that can be used to act efficiently in different real-life situations. They can be technical and non-technical. The discussion on transferable skills focuses mainly on non-technical skills (as, e.g. social skills or problem-solving skills) and partly also on basic technical skills (as, e.g. basic ICT skills) that seem to be useful in many different situations. The underlying assumption is that skills acquired in one context can be (easily) applied and reused in a new and different context. Important questions however are which skills are transferable and how they can be taught and trained in order to supply learners and students with the transferable skills needed for their future employment.

In this chapter, first, an overview on different definitions and conceptualisations of transferable skills is given. Second, transferable skills are discussed with respect to the employability of individuals. Transferable skills are important in recruiting

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new employees as they promise that an individual becomes quickly competent in new situations (Rarrek and Werner 2012). Third, the assumption that transferable skills are transferable is critically evaluated, as there is evidence that skills cannot be easily transferred between different contexts (Gurtner et al. 2007; Sternberg 2005). One reason is that skills develop within a specific context and are thus bound to this context. Individual, social and contextual factors determine the actual transfer of skills. Fourth, the way in which skill transfer can be fostered through education and training will be discussed. How and whether skills can be transferred at all has been an issue in policy, education and personnel selection already for a long time (Fine 1957).

34.2 Definitions: Transferable Skills as Part of Competence

Transferable skills have different names, reflecting different perspectives on these skills and also different eras (RPIC-ViP 2011). The terms used to describe transferable skills vary, such as basic skills, generic skills, employability skills, key skills, key qualifications or even essential competencies or key competencies. The definitions of the terms vary considerably; what they have in common, though, is that all assume that the skills considered are transferable between different contexts and situations.

One term used to describe transferable skills is *basic skills*. Basic skills are 'transferable core proficiencies' (Rosenberg et al. 2012: 8), including basic literacy and numeracy skills, critical thinking skills, management skills, leadership skills, interpersonal skills, information technology skills, systems thinking skills and work ethic dispositions. However, some authors restrict basic skills to literacy, numeracy and ICT skills (Miller et al. 2013).

Transferable skills are also described as *generic skills*. These are skills that can be used in a great variety of different jobs in life, as, e.g. literacy, leadership, problem-solving, physical skills, influencing, teamwork, planning, numeracy skills and emotional labour skills (Ramos et al. 2013), communication, time management skills (Teo et al. 2012), lifelong learning skills, technical training skills, oral, written and interpersonal skills, or skills to handle the huge amount of information available due to today's information technologies (Keneley and Jackling 2011).

Further, *employability skills* are transferable skills, which enhance a job applicant's chance to be hired. Employability skills are non-job-specific individual or personal as well as social skills (Blades et al. 2012; Curtin 2004). These skills are 'the skills almost everyone needs to do almost any job' (UKCES 2009: 9). Employability skills refer to skills such as communication in one's mother tongue or in foreign languages, mathematical and technological competence, digital competence, learning to learn, social and civic competencies, sense of initiative and of entrepreneurship as well as cultural awareness and expression (Recommendation of the European Parliament and of the Council of 18 december 2006 on key competences for lifelong learning 2006). Such lists of employability skills have a huge

impact on the content of the training courses, which are offered by education and training providers as they define also a need for continuous upskilling of (young) people. These lists reflect the changing needs of economy and employment policy and are based on expectations regarding future developments and assumed needs of the labour market. An early example of the attempt to capture the needs of employers and to relate them to basic education was the SCANS project. SCANS aimed at identifying 'the necessary functional and enabling skills that society must provide to every child by the age of 16' (Overtoom 2000: 1). Based on a survey with employers and employees in the public and private sector, five categories of *essential competencies* were identified: (1) resources (identifies, organises, plans and allocates resources), (2) interpersonal (works with others), (3) information (acquires and uses information), (4) systems (understands complex interrelationships) and (5) technology (works with a variety of technologies). Developing these requires *basic skills* (reads, writes, performs arithmetic and mathematical operations, listens and speaks), and *thinking skills* (thinks creatively, makes decisions, solves problems, visualises, knows how to learn and reasons) (SCANS 1991).

In a further analysis of different skill frameworks in Australia (Curtin 2004), the following important *key skills* for the future were identified: (1) communication, (2) teamwork, (3) problem-solving, (4) initiative and enterprise, (5) planning and organising, (6) self-management, (7) learning that contributes to ongoing improvement and expansion and (8) technology that contributes to effective execution of tasks.

In a former OECD project on the definition and selection of *key competencies* (DeSeCo) (Rychen and Salganik 2003), four skill domains were defined: (1) subject competencies (knowledge, facts, definitions, concepts, systems), (2) methodological competencies (skills, fact-finding, analysis, problem-solving), (3) social competencies (communicating, working interactively, citizenship) and (4) personal competencies (attitudes, values, ethics) (Stevens n.d.; Weinert 2001). These skill domains were defined based on a common understanding that individuals need to have the qualifications to act autonomously, to use tools interactively and to function well in socially heterogeneous groups.

In higher education in Europe, the Tuning project recently described transferable skills as *generic competencies* (González and Wagenaar 2005: 204), *system competencies* (González and Wagenaar 2005: 327) or *soft skills* (González and Wagenaar 2003: 116). There is a distinction between subject-specific and generic competencies. Generic competencies are defined as transferable skills or general academic skills. These different terms used by the authors '… may be considered as having the same meaning. They relate to those competences, which are common and can be identified in different degree programs at a certain level' (Tuning 2007: 20). Finally, three types of transferable skills were identified by the Tuning project: (1) instrumental skills (cognitive, methodological, technological and linguistic abilities), (2) interpersonal skills (social interaction and co-operation) and (3) systemic skills (abilities and skills concerning whole systems combining understanding, sensibility and knowledge) (González and Wagenaar 2005; González et al. 2003).

This list of definitions and taxonomies of transferable skills could easily be further expanded. The examples illustrate that there is no generally accepted set of transferable skills. However, there is an agreement that transferable skills describe useful skills to (potentially) act efficiently in different real-life situations. In almost any situation or occupation, people need to have (1) fundamental skills, such as literacy, using numbers and technology, (2) people-related skills, such as communication, interpersonal skills, influencing skills, negotiation skills, teamworking skills, customer service skills or leadership skills, (3) conceptualising/thinking skills, such as managing information, problem-solving and planning, (4) skills related to the business world, such as innovation skills and enterprise skills, and (5) skills related to the community, such as citizenship skills (Greatbatch and Lewis 2007: 6–7).

34.3 The Value of Transferable Skills for Employment

Research on personnel selection and career development shows that individuals possessing more or better transferable skills are valued higher by employers (Fugate et al. 2004). Transferable skills serve as signals that raise the employability of an individual (Bangerter et al. 2012). From the perspective of an employer, an individual is employable if there is a match of his or her skills with the demands of the labour market and the organisation (Hennemann and Liefner 2010). All things equal, a person with better social or other transferable skills will eventually be seen as better employable than a person with less social skills. Consequently, employees should invest in their skill development to enhance their chances to be hired, to secure employment or to find a new job more easily (RPIC-ViP 2011).

During job applications and interviews, transferable skills can help job applicants to show socially desirable behaviours, such as being polite, listening to others or showing interest (Hogan et al. 2013; Van der Heijde and Van der Heijden 2006). In job interviews, employers consider transferable skills as important criteria, as these skills indicate if a new entrant will be able to collaborate with co-workers and to become integrated into the team and the organisation (relational or people skills) (Hogan et al. 2013). Social skills and good habits are especially important in personnel selection of young people (Neuenschwander and Nägele 2014; Stalder 2002; Stalder and Stricker 2009). As school leavers do not have much work experience, employers need to rely on other information. They have to base their hiring decision on school records and transferable skills shown during the job interview to judge whether the young applicants would perform and integrate well in the organisation.

Whether or not transferable skills are seen as important also depends on an individual's hierarchical position within an organisation. In a study on the understanding of transferable skills in Australian companies, Hawke (2004) reported that employers see transferable skills generally as positive, especially in personnel selection. Executives believed that all employees ought to have transferable skills. Middle management felt that it could be desirable to develop transferable skills

and that it is the responsibility of the employee to develop them. Employees themselves did not believe that transferable skills were important in practice (Hawke 2004: 133).

34.4 The Restricted Transferability of 'Transferable' Skills

The assumption that transferable skills are (easily) transferable has been questioned by several authors. Reflecting the generic skill discussion in the UK, Canning (2007: 18) concludes that there is little convincing evidence, which supports the argument that skills can be transferred across situations. Canning argues that transfer is '… probably better understood as a "metaphorical" discourse than an empirical phenomenon'. The promise of transferable skills is that when individuals move to another context (e.g., new job or employer), they should be able to reuse and apply previously acquired skills with ease. In most descriptions of transferable skills, it is mainly an individual's capacity to transfer these skills, as they are part of an individual's competence.

However, it is well known that even competent individuals sometimes fail to transfer skills between situations, that is, from training to work or between different work situations (Saks et al. 2014). If they fail, it is not necessarily because of their incapacity, but might be due to other personal factors. The transfer might be limited if individuals lack metacognitive strategies or the willingness and motivation to use and adapt previously acquired skills to a new work setting. Successful (skill) transfer is an active process in which skills are transformed and adapted to the new situation (Hinrichs 2014; Bransford et al. 2004; Baldwin and Ford 1988; Ford and Weissbein 1997).

Moreover, skill transfer might also be hampered by organisational or work conditions. The routine, the expectation and attitudes of other employees, their low motivation to accept new ideas, the hierarchy within the new team and the organisation might hinder the transfer of skills. A crucial phase is the organizational entry of a newcomer. During organizational entry, the transfer of skills is encouraged through organisational socialisation tactics (Bauer and Erdogan 2011; Kammeyer-Mueller and Wanberg 2003). However, socialisation processes are dynamic learning processes that unfold over time (Ostroff and Kozlowski 1992) and a successful adjustment relies on becoming socially integrated (Nägele and Neuenschwander 2014). Thus, the transfer of skills is heavily influenced by these social learning and adjustment processes.

Organisational entry is often described as a stressful confrontation with reality or even as a reality shock. Newcomers need to achieve role clarity to perform effectively and have to situate themselves in the organisational context. Socialisation during organisational entry includes transfer of skills acquired at school, in previous work places and in training settings: prior skills are applied, shaped and transformed. It is a crucial phase in which it is decided whether the mutual expectations

of employers and employees are met and whether new employees become fully functional and accepted co-workers (Bauer and Erdogan 2011; Wanous 1992).

Transfer might also be restricted by occupational demands, because transferable skills become more contextualised and occupation specific than in previous times (Sung et al. 2013). Following Fine (1957), skills can only be transferred across settings, if the skills needed in both settings are similar. A skill is, for example, the capability to bake bread. Assume a baker who works in a bakery with high quality standards and mass production of bread. After some time, the baker moves to a small, highly specialised bakery, which focuses on sustainability and the use of organic products. In the former bakery, there has been a steep hierarchy and clearly defined roles. In the new bakery, the hierarchy is less pronounced and work is done cooperatively and flexibly. Part of the baker's job remains the same. Basically, what she has to do is the same: baking bread, communicating with colleagues and eventually handling social conflicts. But she cannot use her transferable skills in the same way as she did before, because the social situation and the work process have changed significantly. The baker has to readjust her skills – not only the technical but also the non-technical 'transferable' skills.

Sung et al. (2013) propose a contextual perspective on transferable (employability) skills: 'there is emerging evidence that employability skills are progressively orienting towards a work-based concept. Further understanding of the nature of employability skills is unlikely unless future research examines the connection between employability skills utilization and the work context' (Sung et al. 2013: 191). The skills demanded by employers differ not only between but also within economic sectors and between occupations. In consequence, to advance the discussion on transferable skills, a systematic analysis of relevant job tasks would be needed (Lance et al. 2012).

The complexity of skill transfer and the interdependence of individual and contextual factors have been an important topic in workplace training research (Blume et al. 2009; Cheng and Hampson 2008; Holton et al. 2000; Saks et al. 2014). Workplace training is typically oriented towards specific needs of trainees and their organisation, and the skills trained are close to specific job requirements. Despite this proximity of training and work context, the transfer of these skills is not guaranteed (Burke and Hutchins 2008). Several factors have been identified in training research that might have an influence on the transfer of skills. First, it depends on the cognitive ability of the employee as well as on other individual characteristics such as conscientiousness or voluntary participation (Saks et al. 2014). Second, transfer is influenced by social processes at work (Katz and Kahn 1978). The work environment can foster skill transfer if there is a transfer-friendly organisational climate, a supportive supervisor and support by the workgroup (Saks et al. 2014) and if opportunities to perform what was trained are offered (Burke and Hutchins 2007). As Baldwin and Ford (1988) proposed, characteristics of the trainee (ability, personality, motivation), the training design (principles of learning, sequencing, training content) and the work environment (support, opportunity to use what was trained) are major factors that foster or hamper the transfer of skills. In a more recent review, Burke and Hutchins (2007) came to the same conclusion. Individual

characteristics of the learner, the training or intervention design and the work environment play an important role in the transfer of skills. Individual characteristics are the cognitive abilities of learners, their self-efficacy, their motivation, their commitment to the occupation and organisation, personality-related factors such as low anxiety and high openness to experience, the perceived utility of the training and the fit between training contents and career plans. The training or intervention design facilitates the transfer, if the learning goals are clear and the learning contents relevant and if the training includes practice with feedback, behavioural modelling and error-based examples. Finally, the work environment must be ready to accept and support the transfer of skills.

Overall, while research posits that the transferability of skills from one to another situation might be limited in practice, it remains a political issue. On the one hand, the 'appeal of the idea of transferability of skills seems to be based on the ideal of economy and efficiency – the avoidance of waste' (Fine 1957: 809). This can also be seen in current discussions on qualification frameworks and initiatives to raise the employability of all people. According to Sung et al. (2013: 180), there is an 'attempt to mass-produce employability skills, with the assumption that these skills were highly transferable and equally applicable for young entrants to a wide range of jobs'. On the other hand, there is evidence from training research that skills are developed in specific contexts. Successful skill transfer does not only depend on the individual's capacity and motivation but also on occupational, social and organisational factors. With respect to such contextual factors, the role of the new entrant in an organisation and how she or he is integrated should be addressed more explicitly. A successful transfer of skills is shaped by the onboarding activities of an organisation and organisational socialisation processes.

34.5 Fostering Skill Transfer Through Educational Programmes

In practice and in research on transition from school-based upper secondary and tertiary education to work, the development of transferable skills is seen as an important means to enhance the employability of graduates and to foster lifelong learning and positive career development (Brown et al. 2003; Holmes 2013; Kirves et al. 2014; Tymon 2013). To support students' employability, many educational institutions integrate the development of transferable skills in their curricula (Tymon 2013) by providing, e.g. specific career-related courses and work-based learning experiences (Deeley 2014; Kuijpers et al. 2011). Within higher education, these initiatives seem to foster the development of slightly better transferable skills such as problem-solving, communication and entrepreneurial skills (Wilton 2012). Internships and work-based learning experiences also have a positive effect on the students' motivation (Eden 2014). In addition, a positive effect is found for students who engage in extracurricular activities, e.g. in scout's clubs, sports, music or arts

(Lau et al. 2014). Educational initiatives aim further to enhance students' career competencies above and beyond the development of academic skills. They refer to, e.g. students' reflection on their knowledge, skills and abilities, their career desires and goals and their career planning behaviour (Hirschi et al. 2015; Kuijpers et al. 2006). Students with high career competencies are concerned about their future, feel in control about their career and are confident regarding their capacity to shape their career development (Savickas and Porfeli 2012). They adapt more easily to new work situations and are more successful in their career (Kuijpers et al. 2006). Nevertheless, many employers still complain that graduates from higher education have poor employability skills or transferable skills. According to the employers, students still lack those transferable skills that are needed for the modern workplace (Bowers-Brown and Harvey 2004; Cumming 2010).

A more specific way to structure school-to-work transitions is provided by vocational and professional education and training programmes. Although systems and practices of vocational and professional education and training differ, it is common to all programmes that learning is situated and tied to real work material and social situations (Stalder and Nägele 2011; de Saint-Georges and Filliettaz 2008). Vocational and professional education and training helps to build up professional competence that is relevant for specific occupations. This includes also the acquisition of skills, which foster the transfer of task- and occupation-specific skills between different situations. Whether successful transfer is possible is again linked to individual and contextual factors: it depends on the task, social processes, guidance and support of the workplace trainer. Critical voices have sometimes argued that the skills acquired through vocational and professional education and training are too narrow and only related to very specific tasks and situations, resulting in skills which are not transferable.

Several conditions make vocational and professional education and training, and especially apprenticeships, a good place to acquire transferable skills.

First, learning in vocational education and training is social learning in a social, multimodal context (Billett 2001; Lave and Wenger 1991; Billett and Choy 2013). Second, learning in an apprenticeship is learning in real-life situations, such that learning and work are immediately and bidirectionally linked (Gessler 2012; Hinrichs 2014). Third, in an apprenticeship, skills are developed in a process of theory-based education (school based), reflected observation and guided practice (training in real-life situations), as described in the concept of cognitive apprenticeship (Collins et al. 1989, 1991; Collins and Sawyer 2006).

During the organisational socialisation and learning process, learners acquire skills and develop a holistic understanding of their work (Rauner and Maclean 2008), which allows them to work independently and task oriented, while respecting the standards of the occupation (Rauner and Maclean 2008). A learner acquires skills alongside strategies on how to develop and apply these skills in real-life situations. Through VET learners establish also an occupational identity, self-confidence and a feeling of being competent, which gives them the safety to transfer these skills to other situations (Stalder and Nägele 2015; Fugate et al. 2004; Kirves et al. 2014).

Individuals who were trained to proficiency in one job can apply knowledge and skills they have acquired in learning another job (Lance et al. 2012). Again, learning in the workplace does not automatically lead to the development of transferable skills. Learning in the workplace is often in conflict with the urgency of working on a task and respecting deadlines (Sofo et al. 2010). This time pressure and the focus on completing a task in time can hinder learning, just because there is no time left for learning and the focus of attention is not on learning. In addition, the mere execution of a task does not automatically help to build a conceptual understanding of the task and the conditions of task completion. Learning tasks in vocational education and training need to be adapted to the status of the skills already developed. If a task is too complex and demanding, an apprentice or newcomer will fail. On the other hand, tasks that are too simple or too repetitive imply no learning potential. Any execution of a task, and especially complex tasks, is steered by cognitive processes and knowledge, so time and attention is needed to build the mental and cognitive representations to do a task (Hacker 2005; Rasmussen 1990; Semmer et al. 2000; Steiner 2007).

A way to achieve this is through processes of deep learning. Deep learning is an orientation towards understanding the learning content. It is different from surface learning, where the aim is to reproduce the material (Deeley 2014). Deep learning occurs if a leaner gets captured by the task, which can be facilitated when theory and practice fall together. It is in a sense not just engaging the head in learning but also the heart and the hands (Reynolds et al. 2012). Deep learning facilitates the development of a conceptual understanding of the tasks to be done. It promotes the transfer of skills, as the learner is critically and exhaustively asking questions to explore and understand the task and how this task is related to the overarching goals of the team or organisation.

According to Tricot and Sweller (2013: 279), deep learning implies that it is first of all important to acquire domain-specific knowledge and to develop domain-specific skills: 'We might guess that most school teachers in most schools continue to emphasise the domain-specific knowledge that always has been central, making little attempt to teach domain-general knowledge. Based on our argument, they should continue to do so'. This is also important in vocational education and training which has a strong focus on developing domain-specific knowledge and skills. However, while deep learners acquire the skills in mastering a concrete task, they build at the same time the competence to transfer these skills to another situation.

Finally, instructing people at the workplace is a demanding pedagogical challenge (Billett 2002; Eurotrainer 2008). The quality of social relationships (Nägele 2013) and the support of trainers (Hofmann et al. 2014) becomes an important issue, as learning in the workplace relies on participatory practices that include securing appropriate guidance from experienced co-workers (Billett 2002). This guidance can be spontaneously provided, explicitly requested, collectively distributed or implicitly denied (Filliettaz 2010).

In short, similar to skill transfer of adults, who participate in workplace training programmes (Burke and Hutchins 2007), learning in vocational education and training depends not only on the individual characteristics of the learner but also on

occupational, work and organisational factors. To acquire transferable skills, a learner must gain access to the learning resources in the workplace. The gatekeepers of these resources are the trainer and co-workers. Socialisation processes play therefore an important role in developing skills and competence and in applying them to new work settings (Ashforth et al. 2007).

34.6 Conclusions

As stated in the beginning of this chapter, skills are an essential component of competence, which deserve separate attention in debates about competence, competence development, competence assessment and employability. Transferable skills are conceived as essential for professional competence.

In this chapter, transferable skills have been described as skills which are relevant and helpful across different situations and areas of life. It has also been acknowledged that definitions of transferable skills vary over time and according to the changing demands of employers (Bennett 2002). Transferable skills are given different labels as, e.g. generic skills, employability skills, basic skills or key competencies.

Consequently, there is no single or definitive list of transferable skills. Nevertheless, there is a set of skills that can consistently be found in descriptions of transferable skills: fundamental skills (e.g. numeracy, literacy), people-related skills (e.g. communication skills), conceptualising skills (e.g. problem-solving), business-related skills (e.g. innovation) or community-related skills (e.g. citizenship).

Transferable skills play an important role in the recruitment and selection process and during organisational entry. First, they add to an individual's feeling of being competent and employable (Fugate et al. 2004). Second, transferable skills serve as signals to future employers, as employers are looking for new employees with a high potential to integrate themselves in work teams and the organisation (Bangerter et al. 2012). Third, transferable skills are important during the job interviews and during organisational entry. Job interviews are heavily steered by role expectations and social stereotypes, as neither the applicant nor the employer has much other reliable information on how the newcomer will perform in the new organisation (Ashforth 2012). That's why transferable skills play an important role in increasing the employability of (young) people.

The assumption that transferable skills are (easily) transferable has been questioned by several authors. Transferable skills need to be adapted during organisational entry to the new organisation or situation. For example, students need to learn that problem-solving at the workplace can be quite different from how problems were solved at school. There is strong evidence from training research that the transfer of prior knowledge and skills to a new situation or organisation depends as much on individual factors as on contextual factors, including the work design, the organisational climate and the workgroup. As every organisation is a social system with definite goals, expectations and rules (Katz and Kahn 1978), the transfer of skills

becomes a joint responsibility of the newcomer and the organisation. This responsibility of the organisation and team to enable and foster the transfer of skills becomes especially important in transition from school to work, as the positive development of young workers seems to rely primarily on their social integration (Nägele and Neuenschwander 2014). Overall, the transfer of skills can be facilitated if the training setting is close to the work setting and individuals and if organisations have the resources and the willingness to support the transfer of skills (Holton et al. 2000).

Vocational and professional education and training and especially company-based apprenticeship programmes can facilitate the transfer of skills, if they build on situated learning in real-life work situations, and activate deep learning. Vocational and professional education and training does not help to develop transferable skills per se. It depends on how skills are developed through guidance (Billett 2000), appropriate instruction (Semmer et al. 2000) and individual as well as group reflection (Gurtner et al. 2007).

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Chapter 35
Factors Influencing Professional Development in Teacher Teams within CBE Contexts

Piety Runhaar

35.1 Introduction

Vocational education and training (VET) is, worldwide, increasingly shaped in competence-based ways (Mulder et al. 2007). This means that the competencies needed in professional practice form the starting point of curricula instead of separate' academic disciplines (Biemans et al. 2004). An important cause of this switch lies in a disconnection between education and labour market needs. More specifically, increasingly, employers in many countries experienced a gap between educational programmes and graduates' qualifications on the one hand and the competencies employees need in practice to perform well on the other (Mulder 2014). Furthermore, new psychological insights into learning have lead educators to rethink the way students can best develop their competencies. Parallel to current approaches of employees' learning, student learning is nowadays understood as a process in which students actively construct their knowledge together with others (McLaughlin 1997). In competence-based education (CBE), students develop their competencies by building meaningful relationships between knowledge, skills and attitudes in professional practice. This way of learning increases students' learning motivation and in turn enhances their achievements (Schaap et al. 2012).

CBE distinguishes itself from 'traditional', discipline-based education in several respects. For instance, professional core problems are the organising unit for (re) designing the curriculum; learning takes place, to a large extent, in work place setting or settings which are representative for the work situation; the competence development of students is assessed before, during and after the learning process; and much attention is paid to the stimulation of self-responsibility and (self-) reflection of students (see, for more, Wesselink et al. (2010)).

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All together, the switch to CBE is fundamental, and like is the case in all educational innovations, its success depends to a large extent on the competence and efforts of teachers and trainers to make sense of the principles of CBE and to put them into practice. That is, competence is nowadays conceptualised from a 'situated professionalism perspective' (Mulder 2014), meaning that competence gets its meaning in the specific context in which it is used. Generic competencies, which are relevant for many professions, like planning, communication, etc., get meaning in a specific context. For instance, communicating for a technician means something different than communication for a hairdresser. In an attempt to make every form of competence development measurable, VET institutions run the risk of narrowing down competencies to a set of quantifiable technical skills (Biemans et al. 2004). Hence, a true transformation of curricula into competence-based education programmes requires from teachers and trainers that they develop new conceptions about learning and assessment (Gulikers et al. 2013) and that they fulfil other roles than they are used to, like coach or tutor (Seezink and Poell 2010). Hence, professional development of VET trainers and teachers in what competence-based education exactly *is* and *how* it can be put into practice has become of crucial importance (Guthrie 2009). This chapter is focused on how teachers' professional development within the CBE context can be stimulated.

The fact that different disciplines need to be integrated in the curriculum makes the implementation of CBE a team responsibility. Instead of being responsible for instruction in one or two subjects, teachers need to collaborate with each other in order to develop and implement educational programmes, like for hairdressing or construction (e.g. Wesselink et al. (2010)). Hence, the 'collective competence' (Boreham 2004) of teacher teams may be even more important than individual teachers' competence. So, in many countries, VET institutions are implementing team-based organisation structures (Park et al. 2005). As is the case in many organisations nowadays, in VET institutions, teams are not only increasingly viewed as important 'working units' but also as important 'learning units' within the organisation (Decuyper et al. 2010). Hence, in examining how vocational teachers and trainers can be stimulated to engage in their professional development, the chapter focuses on teachers' *engagement* in *team learning activities*.

The chapter will give insight into factors at different levels, which have been addressed in the literature on team learning of professionals in general and teacher learning literature specifically and which relate to employees' engagement in team learning activities. After this, human resources management (HRM) is proposed as an integrative means to stimulate team learning in VET teacher teams. The concept of HRM refers to all policies, procedures and practices that are explicitly targeted at attracting, retaining, developing and rewarding teachers in such a way that it results in optimal teacher, team and school performance (see also DeArmond et al. (2009)). HRM is widely seen as a powerful means to influence employees' behaviour. For instance, HRM can increase employees' commitment to organisation goals and as such enhance employee performances (Boselie et al. 2005). HRM research, however, mainly takes place within profit organisations and scarcely within the educational sector (Smylie et al. 2004). Moreover, HRM research is often focused on

attitudes and behaviours of individual employees and linked to their performances. Although there is a trend to link HRM to employees' learning behaviour, the concept of team learning is still relatively under-researched. This chapter, in this way, aims to combine insights from several scientific domains – namely, HRM, team learning and educational sciences – in order to examine how VET teachers' engagement in team learning activities can be stimulated by means of HRM.

Before the chapter continues, it is important to note that HRM has a built-in tension in that it can be viewed as a means to control employee performance and enhance efficiency, on the one hand – for instance, by means of performance appraisals – and as a means for enhancing work engagement and development of employees, on the other hand, for example, by means of offering development opportunities (e.g. Runhaar and Sanders (2013)). Research shows that HRM systems which are primarily focused on control lead to employees following instruction and doing just what they are told and to a decrease of engagement, whereas HRM systems which mainly focus on commitment enhance employees' initiative and intrinsic motivation (Mossholder et al. 2011). Due to the fact that governments strive to enhance student achievements and to hold schools accountable for this by means of measurable outcomes, VET institutions run the risk of stressing the 'control' aspects instead of the 'commitment' aspects. In this chapter, the focus will therefore be on the commitment elements of HRM.

35.2 Team Learning in Teacher Teams: A Situated Perspective on Learning

The concept of team learning refers to the various activities team members can undertake in order to 'acquire, share and combine knowledge through experience with one another' (Argote et al. 2001: 370). The idea is that through interactions between team members, knowledge and skills gathered by one team member can be transferred to other team members (Van Woerkom and Croon 2009). The exchange of knowledge, experiences, skills and ideas, in turn, enables teams to develop a shared understanding of the complex problems and demands they are confronted with and enables teams to find effective ways to deal with those problems and demands (Decuyper et al. 2010). This added value of team learning has become increasingly crucial to organisations' success.

Within literature on teachers' professional development and team learning, authors have distanced themselves from the 'traditional' training paradigm that implied a 'deficit-mastery model', wherein teacher learning and change was considered as something that 'is done to teachers' (Clarke and Hollingsworth 2002). Nowadays, authors adhere to the *situated perspective on learning* (see also Chap. 1 of this volume) which refers to learning which is often initiated by the learners themselves and which takes place in the same context in which it is applied (Lave and Wenger 1991). In fact, here we see a link with the way competence development of VET students is conceptualised, namely, from a situated professionalism

perspective (Mulder 2014). And just like the assumptions in competence-based education, the idea within this perspective is that learning should not be perceived as a transmission of abstract knowledge from one individual to another, but as a social process which is situated in a specific context and embedded within a social and physical environment. The knowledge and insights that professionals need to continuously develop themselves are embedded in their daily practice and are co-constructed in interactions among colleagues. These ideas are, for instance, reflected in literature on 'workplace learning' (Malloch et al. 2010) and 'communities of practice' (Tynjälä 2012).

35.2.1 Team Learning Activities

Team learning can consist of different kinds of activities. Next to *formal* learning activities, like following courses or training off-the-job, also the less structured forms of *informal* learning, like collaboration and feedback exchange, can foster team learning (e.g. Marsick and Watkins (2001)). Also, theorists on organisational and team learning propose that learning takes place at different levels, like the individual, interpersonal, team and organisational level. Feedforward processes push lower-level knowledge upwards, while feedback processes facilitate the application of what has been learned at higher levels (e.g. Crossan et al. (1999)). Hence, team learning can take the form of *individual activities*, like self-reflection, keeping up-to-date and observing others, as well as of *interpersonal activities*, like knowledge sharing or problem-solving with colleagues (e.g. Bakkenes et al. 2010; Runhaar et al. 2010) and *team activities* like the storage and retrieval of knowledge (DeCuyper et al. 2010).

35.2.2 Team Learning: Risks and Potential

Reflective practice is, more or less implicitly, at the heart of all team learning activities. For instance, asking for feedback or experimenting with new learning methods implies a reflection on current practice. Also, on a team level, when teams evaluate their performance, this implies a reflection on their results and also on the way these results were accomplished. Critical reflection can, therefore, be viewed as a means to reconstruct the implicit assumptions that underlie one's actions and to develop other more sophisticated conceptual structures about teaching and education (e.g. SchÃ¶n (1983)). Despite the potential learning outcomes of reflective practice, we also know that teachers and teams can have difficulty with reflection on their own assumptions and with adopting new ones. For instance, changing one's assumptions concerning students' learning and one's own role in the learning process of students can lead to the idea that one has failed in the past (Runhaar et al 2010). Moreover, by sharing knowledge or asking for feedback, one runs the risk of criticism and, as

such, of being confronted with information that can affect the self-image (Van Woerkom 2004). Hence, people and teams may feel hesitant to engage in learning activities. In the following section, individual and work environmental factors will be presented that may stimulate teachers to overcome the risks associated by learning and, instead, to accentuate its potential.

35.3 'AMO Theory of Performance' as Conceptual Framework

Like all human behaviour, teachers' engagement in team learning activities can be viewed as a function of individual and contextual factors. To distinguish between the kinds of individual and contextual factors that play a role in explaining employee behaviours, organisation psychologists and management scientists often rely on the so-called AMO theory of performance (Appelbaum et al. 2000). This metatheory states that performance (P) is a function of employees' abilities (A), their motivation (M) and the opportunities (O) they are offered to perform. In the course of time, this theory has been used to model different kinds of behaviours within organisations, like employees' engagement in learning activities (see, for instance, Runhaar et al. (2010)). In the following, the AMO theory will be used to categorise different types of stimulating factors. Note that it is not the intention to offer a complete picture. Rather, the goal is to gather 'ingredients' of HRM policies and practices that can be used in VET institutions in order to stimulate team learning.

35.3.1 Ability (A) Factors

Team learning activities imply certain skills from the learners. On one hand these skills are related to working in a team, like teamwork and communication skills. On the other hand, these skills are related to learning, like reflection and feedback skills. Let us take reflection skills as an example: reflection is often conceived as a cyclical and recursive process which includes problem-solving that coincides with awareness raising in order to construct professional knowledge (Mena Marcos et al. 2011). Reflection can be viewed as a metacognitive ability which teachers start to develop during teacher education (or earlier in their lives) and which they can further develop during their careers. Literature shows numerous ways in which reflection ability can be promoted, varying from online discussion tools (Whipp 2003) to autobiographical tools and action research (e.g. Etscheidt et al. (2012)). So if certain skills are not present, teachers can undertake action to develop these skills, alone or as a team.

Next to these kinds of abilities, also *the sense of being able* plays a role. A concept which is often examined in relation to learning and development, especially in

the context of educational innovations, is 'self-efficacy'. *Self-efficacy* refers to the extent to which people believe in their ability to complete tasks and to reach their goals (Bandura 1977). A high sense of self-efficacy is related to the assumption that, with effort, one can improve oneself. As stated above, the 'risk' of receiving negative feedback is often inherent to learning activities like knowledge sharing or collegial observations. The higher one's self-efficacy, the lesser one is afraid to be vulnerable and to reveal what one still has to learn and to openly doubt about one's practice or assumptions. That is, negative feedback will not have a high impact on the self-image if self-efficacy is high (Runhaar et al. 2010).

In parallel to these individual processes, also at a team level, sense of efficacy seems to play a role in team learning. Van den Bossche et al. (2006) found that when the 'group potency' is high (i.e. the collective belief of group members that the group can be effective), more team learning takes place. The belief in the group's effectiveness strengthens the idea that investment will pay off and so encourages processes of learning.

35.3.2 Motivation (M) Factors

Being able and *daring to engage* in team learning activities is one thing, *being motivated* to engage in those activities is another. The goal orientation theory states that goals are important for the motivation of behaviour, for task interpretation and for how employees react to work outcomes (Dweck 2000). Two types of goal orientation are distinguished in the literature – the *learning goal* and the *performance goal* orientation – and people tend to prefer one above the other (Dweck and Legett 1988). The learning goal orientation refers to employees' motivation to continuously improve one's competencies through learning and training new skills, as well as through learning to complete new and more complex tasks. The performance goal orientation refers to employees' motivation to perform better than others, to seeking affirmation of one's competence and to avoid negative feedback. When people have a strong learning goal orientation, they tend to view feedback, whether positive or negative, as diagnostically relevant information that helps them to increase their competence (VandeWalle 2001; Tuckey et al. 2002). In case of high goal orientation, people are likely to view activities like asking for feedback, letting others observe you and experimenting with new teaching methods as challenging ways to grow rather than as 'scary' activities that may affect their self-image. On the other hand, when people mainly are performance goal oriented, they tend to view ability as difficult to develop and tend to attempt to validate and demonstrate the ability they possess (Dweck and Legett 1988). As a result, they tend to avoid activities which imply the risk of receiving 'disconfirming information', like asking for feedback, sharing knowledge, etc. (VandeWalle 2001; Runhaar et al. 2010).

35.3.3 Opportunity (O) Factors

Having competent, self-confident and motivated teachers is not enough to ensure that team learning will take place. The work environment wherein teacher teams are embedded must also offer enough opportunities for teachers to learn with and from one another. Factors in the work environment can be more proximal or more distal to teachers' work. Therefore, often a distinction is made between factors at task, team and organisation level (Runhaar et al. 2009). In this section, examples of factors at the different levels will be given.

35.3.3.1 Task-Level Factors

In order to translate CBE principles into teaching materials and methods and into the curriculum, teams and individual team members need a certain level of *autonomy*. Autonomy refers to the ability to control various aspects of the work, like tempo, working methods, planning and goals. Autonomy has positive effects on employee motivation (e.g. Deci and Ryan (1985)), their openness to new insights and perspectives (Parker and Wall 1998) and their willingness to implement changes (Cunninghamn et al. 2002). Moreover, autonomy is a prerequisite for experimentation with new methods (Bransford et al. 2005).

Next to the autonomy, also the *workload* and *work pressure* teachers and teams experience play a role in the amount of team learning that occurs. In case of high workload and pressure, teachers will prioritise their core tasks above 'extra' engagement in learning activities. Workload and work pressure can be related to several task aspects like the amount of teaching hours and classes, the complexity of the student population or the relationship with the manager (see, for instance, Hakanen et al. (2006)). Moreover, there is no objective measure of workload and pressure. That is, every teacher experiences the workload in his/her own way, and teachers differ from each other in how optimistic they are about the resources they possess to cope with the workload (e.g. McCarthy et al. (2009)). Workload, thus, needs to be a recurrent topic in conversations between management and teachers and teams.

35.3.3.2 Team-Level Factors

Although teachers in VET institutions increasingly work in teams, this is not to say that collaboration and learning automatically occur within these teams. The fact that teachers have long been used to working in isolation often impedes interaction among teachers (Silins and Mulford 2002) and consequently hinders learning from each other. Different authors have already stressed that interdependence among team members is at the heart of teamwork (Decuyper et al. 2010) and specifically needed for learning to occur (e.g. Little (2003)). This is especially true for teachers' learning in the context of CBE, which is an interdisciplinary, collaborative effort.

Teachers can be interdependent in different ways. Authors often make a distinction between *task interdependence*, defined as the work flowing from one team member to another in such a way that the task performance of one member depends on the task performance of the other (Kiggundu 1983), and *goal interdependence* – referring to the extent to which team members have to contribute to the achievement of group goals (Deutsch 1973). These interdependencies are considered factors that determine the amount and quality of interaction among team members to a large extent (Van der Vegt and Janssen 2003) and also teachers' engagement in learning and team learning activities. The first reason is that interdependence in itself influences the *degree of interaction* between team members (Campion et al. 1993), which can be considered an important prerequisite for learning together with colleagues. Interaction between colleagues enhances the exchange of ideas, experiences and practices, which in turn may lead to reflection on one's own practice and underlying assumptions (Meijrink et al. 2009). The second reason is that interdependence influences the *quality of interaction*. Task interdependence enhances employees feeling of responsibility for each other's task outcomes (Kiggundu 1983) and to team members seeking and giving each other advice when confronted with problems (e.g. Wageman (2001)). When people perceive that their goals are positively related (i.e. goal interdependence), they are motivated to find manners in which mutual goals can be achieved and to resolve issues for mutual benefits. To this end, they aim to integrate their ideas (Deutsch 1973). Research has shown that goal interdependence is positively related to open-minded discussion and diverse views (e.g. Deutsch 1973; Johnson and Johnson 1989). Under the circumstances of high task and goal interdependence, teachers are more likely to engage in learning activities despite the risk of being 'vulnerable'. To give an example, experimenting with competence-based education methods or assessments implies the risk of failure or criticism from colleagues. When all teachers are held accountable as a team for the implementation of CBE, everyone potentially benefits from these experiments which in turn will decrease criticism. Instead, this will enhance the collegial support for new ideas.

35.3.3.3 Organisation-Level Factors

Teams are often embedded in larger institutions where a governing *educational concept* is formulated, for instance, in terms of a mission statement. Teams then have to learn what this concept actually means and how it can best be put into practice. A risk in this process is that teachers, on the base of superficial similarities between the new concept and their current practice, conclude that nothing has to be changed at all (see, for instance, Spillane et al. 2002). To reduce this risk, teacher teams need to be *informed* carefully and repeatedly about the underlying principles of the new educational concepts (Coburn 2004). What works even better is to involve teacher teams in the development of the educational concept. By doing this, a *shared ownership* for the new educational concept can be created which enhances

the acceptance and the willingness to put effort in realising the change (Van der Bolt et al. 2006).

Employees' behaviour is determined to a large extent by the *organisational climate*. Organisational climate refers to the values and norms as perceived by employees and which are enacted by organisational behaviour (for instance, the communication style of managers or relationships among colleagues) and rules and procedures (for instance, HRM and professional development plans) (Burton et al. 2004). The climate can be more or less 'safe' and learning oriented and as such more or less conducive for team learning. Research shows that the more employees perceive the organisational climate as development oriented, the more they tend to engage in learning and innovation (e.g. Van Dam et al. (2008)).

Leaders have an important effect on employee behaviour. Although teams in VET institutions are increasingly self-regulating, they often still have to deal with leaders at a higher level. The way leaders behave and communicate has an important influence on how employees experience the organisation and consequently the way they behave. Specifically in the education setting, school leaders influence the effort teachers put into their jobs (Geijsel et al. 2003), their commitment to educational innovations (Yu et al. 2002) and their engagement in professional development activities in general (Blase and Blase 2000). The *leader-membership exchange (LMX)* theory states that effective leadership derives from mature relationships between leaders and followers (Dansereau et al. 1975; Gerstner and Day 1997). In mature relationships – characterised by mutual trust, influence and respect – leaders and followers develop mutual obligations. Translated to our topic of team learning, this means that when employees can rely on leaders' support and encouragement when needed, or on career investments, they will reciprocate this with effort put into the educational innovation and team learning. In this way, mutual trust and obligations empower and motivate employees to expand beyond the formalised work contract and to put effort in 'higher goals' like educational innovations (Runhaar et al. 2013). Related to LMX theory is the often made distinction between *transactional* and *transformational leadership*, where also an exchange approach to leadership is used (Graen and Uhl-Bien 1995). Transactional leadership refers to the exchange of effort, time, skills and knowledge from the employee vs. salary and secondary labour conditions from the employer (the 'hard' or written part of the labour contract). Transformational leadership refers to the exchange of inspiration, vision and support from the employer on the one hand and engagement, learning and high performance from the employee on the other hand (the 'soft' or unwritten part of the labour contract). Effective leadership develops itself as the focus on material exchange between leader and employee (transactional) and shifts to a focus on social exchange of psychological benefits (transformational). Indeed, research within the context of educational innovations shows that transformational leadership positively influences teachers' commitment to school goals (like CBE), employee learning in general (Lam 2002) and teachers' engagement in reflection, feedback asking, knowledge sharing and innovative behaviour specifically (Runhaar 2008).

35.4 Human Resources Management: An Integrative Means to Stimulate Team Learning

As mentioned in the introduction, the list of factors is not complete, but gives insight into the kinds of factors at different levels that play a role in predicting VET teachers' engagement in team learning activities in the context of the change to competence-based education.

Human resources management (HRM) can be viewed as a powerful means to influence employee behaviour in general and teachers' engagement in team learning activities in specific. With HRM, organisations try to influence employees' ability, motivation and opportunities to perform (Boxall and Purcell 2003). As such, HRM can be viewed as an integrative means that links to all factors listed above. In line with this, Jackson et al. (2006) used the AMO theory of performance in order to define competency-, motivation- and opportunity-enhancing HR practices for, what they call, knowledge-intensive teamwork. They replaced the word 'ability' in the more broader term of 'competency', because the former term refers to a narrow set of individual attributes, whereas the latter term is commonly used to refer to attributes of both individuals and larger social units (see also Chuang et al. (2013)). In line with their work, the following suggestions are formulated for VET institutions that aim to stimulate teachers' professional development within teams.

35.4.1 Competency-Enhancing HR Practices

The primary objectives of competency-enhancing HR practices for team learning are on the one hand to ensure that teams are staffed with members who are competent and who complement each other. On the other hand, these practices aim to facilitate teams and team members to continuously improve their competency. Concerning the *staffing of teams*, it is suggested to *involve team members* in the recruitment and selection of new team members (Chuang et al. 2013). That is, the current team members have best insight into present and missing competencies in the team. Moreover in the search for new team members, not only the technical competencies (needed for core tasks) have to be taken into account but also the *teamwork and learning skills*. Concerning the *development of competence*, teams should be offered training and development opportunities that are related to the specific development issues in teams or individual team members next to institution-wide activities (Chuang et al. 2013). Next to technical competencies, also attention has to be paid to the team learning and collaboration skills. So next to courses or training in CBE matters or subject matters, also training in reflection and feedback exchange or cooperative skills can be offered. Furthermore, supporting teachers in their individual learning needs appears to be preferable to school-wide interventions (OECD 2009) which means that one should as much as possible assure that teachers can attend a course or training when they find that they need it. This presumably also applies to the learning needs of teams. Needless to say, next to formal learning

opportunities, VET institutions need to offer enough time and space for teachers to meet each other as a necessary condition for informal learning.

Related to the role of self-efficacy in teachers' engagement in team learning activities, HR practices can also try to enhance teachers' self-efficacy. According to Bandura's social cognitive theory (Bandura 1977), the social environment can enhance individual's self-efficacy in two ways: by the delivery of positive feedback ('social persuasion') and by offering opportunities to learn from others ('vicarious experience'). A concrete way to address both is by facilitating teachers in observing their team members (or colleagues outside the team) and to actively stimulate teachers to ask feedback from colleagues (for instance, as a preparation for performance interviews). Recognising teachers' performance – under which their professional development, innovative ideas and new solutions to problems – proves another strategy to strengthen teachers' self-efficacy (OECD 2009).

35.4.2 Motivation-Enhancing HR Practices

Given the central role of learning goal orientation in teachers' learning, it is recommended to shape the working situation of teachers in such a way that it promotes their learning goal orientation and creates a so-called *situational learning goal orientation* (Button et al. 1996). This can be done by stressing the importance of teachers' learning by, for example, assuring that teachers have enough time to develop themselves and to learn from each other. Also, by offering teams rewards for their new ideas, it may motivate employees to seek new knowledge and share such knowledge within the team in order to generate creative insights (Chuang et al. 2013).

Within competence-based learning, next to the 'traditional' role of lector, teachers can fulfil different other roles, like the 'learning career' coach of individual students, tutor of a group of students, assessor, educational designer, etc. (Oonk et al. 2013). All these roles require different competencies. Teams thus need people with different qualities, varying from people who have good insight into the developments which take place in workplace settings and the profession to people who possess the ability to assess students' learning needs or career ambitions. The workplace of teachers, in this way, is, in potency, very motivating and also has a high 'learning potential' (Nijhof and Nieuwenhuis 2008). It is recommended to make the different roles and competencies explicit, in order to make teachers aware of the various development possibilities and career paths.

35.4.3 Opportunity-Enhancing HR Practices

The primary objective of opportunity-enhancing HR practices is to create appropriate conditions for teams and team members to engage in team learning (cf Chuang et al. 2013). As we have argued in the former section, these practices can link to the task, team and organisation level. Related to the *task level*, VET institutions have to

ensure that team members and teams have enough autonomy to plan, execute and shape their work. This is needed in order to ensure that teams and team members have enough space to learn about CBE and to find a way to put it in practice. It is also recommended to make teachers' experienced workload a recurrent item in performance or feedback interviews. Related to the *team level*, there should be enough interdependence among team members in order to ensure a certain degree and quality of interactions among team members. The multidisciplinary character of CBE enhances the task interdependence. Goal interdependence can be enhanced by rewarding not only individual teachers for their contribution to CBE but also the team as a whole. This doesn't have to be a pure financial reward; also offering the opportunity to follow a course together or to serve as a model for other teams can be rewarding. Finally, related to the *organisational level*, teams and individual team members must have enough time and room for learning what CBE really encompasses and to experiment with CBE methods and assessments. A first prerequisite is that knowledge about CBE must be available for teachers. This can be done, for instance, by cooperation with educational knowledge centres or universities. Teams need time and space to learn from other teams, within or outside the VET institution. The exchange of 'good practices' can be stimulated, for instance, by means of conferences, organised by several VET institutions together.

Given the important role of leaders, specifically the transformational style, VET institutions are to invest in recruitment and selection procedures for new leaders as well as in management development (MD) programmes for current leaders. Attention should be paid to the topic of team learning and how this can be stimulated as well as to the topic of CBE and how teams can be facilitated in bringing this into their practices.

Finally, concerning the organisational climate, this requires that the importance of team learning is reflected in all communication and behaviours of leaders as well as in rules and procedures in the institution. This cannot be realised by a single HR practice but is related to the HR system as a whole. The following section will elaborate on this more.

35.4.4 A 'Strong HRM System'

HRM, which affects the conditions under which employees' work has to be done, should not be formulated by managers or HRM advisors in isolation, but be developed on the base of a dialogue and negotiation with all stakeholders. Once HRM policies are determined, however, these are not always interpreted by employees as intended (Nishii and Wright 2008). Hence, for HRM to be effective, it is not enough to have good practices (Guest 2011), but the *HRM process* should be taken into account as well (Bowen and Ostroff 2004). Within the process perspective of HRM, HRM is viewed as a means of sending 'messages' to employees about what attitudes and behaviours are expected and rewarded. These messages can help employees to make sense of the psychological meaning of their work situation (e.g. Rousseau 2001). Based on Kelley's (1967) covariation framework, Bowen and Ostroff (2004)

argue that when employees perceive HRM as *distinctive* (the event effect is highly observable) and as *consistent* (the event effect presents itself in the same way across modalities and time), and if they perceive *consensus* (there is agreement among individual views of the event-effect relationship), they can make confident cause-effect relations and understand what is expected of them and rewarded. In turn, this will enhance employee and organisation performance.

Translated to the topic of team learning, in order to stimulate teachers' engagement in team learning activities, the objective of HRM has to be very clear and visible for teacher teams (distinctive), the value attached to team learning has to be present in every single HRM practice (consistent) and all relevant actors within the VET institution have to share the opinion that team learning is important (consensus). Related to these specific features of a strong HRM system, a couple of concrete suggestions can be formulated.

Distinctiveness This aspect of HRM refers to the clearness and visibility with which a VET institution communicates ('sends the message') that team learning is important. It means that HRM practices need to be visible and accessible for teachers. This can be done, for instance, by making 'team learning', 'teacher competence' and 'collective competence' recurrent topics in the 'cycle of conversations' between managers and teams and individual team members. This cycle, for instance, can start off with reflecting on teachers' competence and their developmental needs, be followed by an evaluation of professional development and a performance appraisal, and be finalised by one of several possible outcomes, like a pay increase or the allocation of new tasks. After the cycle has been completed, a new cycle can start (Runhaar et al. 2013). A same kind of system can be applied to the team level where school leaders hold conversations with teams about their collective competence development.

Consistency This can be achieved by an alignment of different HR practices for instance, by means of using teacher competence as a 'leitmotif'. For example, in the Netherlands, the Ministry of Education has initiated the formulation of seven teacher competencies which are adopted by VET institutions in their HRM policies (see for more Runhaar and Runhaar 2012; Runhaar et al. 2013). Examples of these competencies are 'pedagogical competence', 'subject matter didactic competence' and 'competence in collaboration'. The competencies contain a general definition and sub-competencies. Concrete examples of competence at four levels are also provided, which make the framework a practical guidance for teachers' professional development. The competencies can form the starting point for professional development plans (what competencies do I / we have to develop the coming period?), staffing of teacher teams (what competencies are present, which do we need?), performance appraisals and reward. Next to the competence descriptions developed by the Ministry, VET institutions can stress competencies they think are important, like teamwork or learning skills. Using the 'competence language' can enhance teachers' perception of consistency among different HRM practices.

Recently, the Dutch VET council, like the councils for primary and secondary education in the Netherlands, has started with the development of a competency framework for teachers' supervisors (like school leaders or team leaders). Under the title of 'practice-what-you-preach', the most important competencies for managers are being formulated. When VET institutions will start using these in a similar cycle of conversations with their leaders, this would mean an important increase of HRM's consistency and, consequently, its effectiveness.

Consensus Achieving agreement among relevant actors about the goals and features of HRM is important but difficult. Managers are not always educated in the field of HRM, do not all see the added value of HRM or are not aware of the crucial role they play in executing the HRM policy (e.g. Runhaar et al. 2013). Reaching consensus calls for special attention for HRM in Management Development (MD) programmes as well as in management team meetings. Managers can let HRM specialists inform them, but must never forget to validate their HR insights by means of interactions with teacher teams. The teacher teams, of course, know how their collective competence and performance can best be enhanced and what kinds of development opportunities are most suitable.

35.5 Conclusions

The following figure summarises the line of reasoning presented in this chapter, Fig. 35.1.

Team learning can help VET teachers to develop competence-based education, which is inherently a team effort due to its multidisciplinary character. A strong HRM system, characterised by the distinctiveness of and consistency among HR practices and consensus among different actors, can enhance the ability, motivation and opportunities of employees to engage in team learning activities. Achieving a strong HRM system within VET institutions takes time and effort, and, to a large

Fig. 35.1 Link between HRM systems and team learning (cf Chuang et al. 2013)

extent, it relies on intensive internal communication among all relevant actors within VET institutions.

The model is based on theories on learning of employees in general or teachers specifically. Nevertheless, the proposed relationships among the variables call for further empirical studies on how HRM can contribute to VET teachers' learning in the context of CBE.

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Chapter 36
Self-Regulation and Competence in Formal and Informal Contexts of Vocational and Professional Education

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36.1 Introduction

According to Hager (2011), theories of workplace learning have evolved over last two decades from individual to multiple types of learning in both formal and informal contexts. The first set of theories focused on individual's capacities on cognitive aspects of work performance (e.g. Argyris and Schön 1974; Marsick and Watkins 1990). Hager (2011, pp. 20–23) identifies three issues defining these theories: (1) the individual as the unit of analysis for understanding learning, (2) learning as a product or 'thing' (relating to acquisition and transfer metaphors) and (3) learning as independent of context. The second set of theories shifted the focus from the individual towards the role of social, cultural and organisational factors in workplace learning (e.g. Dewey 1916; Vygotsky 1978; Lave and Wenger 1990; Engeström 1987; Fuller and Unwin 2003). The aforementioned three issues could be rephrased as follows: (1) both individual and social as the unit of analysis for understanding learning (relating to participation metaphor), (2) learning as a process and (3) learning as dependent of context.

Hager (2011) notes that although some works (e.g. Eraut 2000; Evans et al. 2011; Billett 2001) mostly belong to the second set of theories, they also combine themes, especially the role of individual, from the first set of theories. According to Billett (2011), self and personal agency play a central role in workplace learning. He states (p. 70) that 'the change or learning that arises from everyday and novel events is associated with how individuals direct their intentionalities and agency when engaging with what they experience through these events'. Hager (2011) also identifies the fourth issue, workplace learning as emergent, in the third set of most recent

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theories (e.g. Engeström 2008), which view learning as an ongoing process that is not fully decidable in advance.

On the basis of the above, we can conclude that individual capacities play an important role when investigating collaborative learning processes in both formal and informal contexts of vocational and professional education. Current research on individual learning capacities focuses on the concepts of metacognition, self-regulation and self-regulated learning. Dinsmore et al. (2008) identify metacognition as research on individual's cognition, self-regulation as research on behaviour resulting from individual-environment interaction and self-regulated learning research combining these two approaches. Kaplan (2008) suggests that these concepts should be seen as subtypes of *self-regulated action*, allowing investigation of different dimensions of self-regulatory processes at the same time. In this chapter, we use the terms 'metacognition', 'self-regulation' and 'self-regulated learning' under the conceptual umbrella of 'self-regulated action', but our focus is on social cognitive perspective on self-regulation.

The purpose of this chapter is to discuss the connection between self-regulation and competence in both formal and informal contexts of vocational and professional education. Our goal is to show via existing research that especially social cognitive dimension of self-regulated action has theoretical linkages to a multifaceted and holistic approach to competence and that self-regulatory abilities play a role in the development of vocational competence. First, we introduce different theoretical approaches to self-regulated action. Then, we proceed to describe current research on competence in the context of vocational skills competitions and link it to the dimensions of self-regulated action. We conclude the chapter by presenting the results of an empirical study that investigates the relation of self-regulation and competence in the context of air traffic control.

36.2 Social Cognitive Perspective on Self-Regulation

Over the past decades, several different models of self-regulated action have been developed: Boekaerts' model of adaptable learning (1992, 1995, 1996a, b), Borkowski's process-oriented model of metacognition (Borkowski and Muthukrishna 1992; Borkowski 1996; Borkowski and Burke 1996; Borkowski et al. 2000), Pintrich's general framework for self-regulated learning (Pintrich 2000), Winne's four-stage model of self-regulated learning (Winne and Hadwin 1998) and Zimmerman's social cognitive model of self-regulation (1994, 1998, 2000, 2002, 2008). Puustinen and Pulkkinen (2001) compared the models of Boekaerts, Borkowski, Pintrich, Winne and Zimmerman on four criteria: background, theories, definitions and components included in the models and empirical work. The results of their work showed that Pintrich and Zimmerman's models were both inspired by the social cognitive theory (Bandura 1986).

From a social cognitive perspective, self-regulation has been defined as self-generated thoughts, feelings and actions planned and cyclically adapted based on

performance feedback to attain self-set goals (Zimmerman 2000). It is a multifaceted, complex process integrating several processes, which are hypothesised to operate in a cyclical feedback loop, whereby a learner gathers and uses feedback information to make adjustments during current and future learning attempts. Zimmerman and Schunk (2008) have defined self-regulation as the control of one's present conduct based on motives related to a subsequent goal or ideal that an individual has set for him- or herself. Self-regulation is the control that people have over their behaviour, cognition, emotions and motivation through the use of personal strategies to achieve the goals they have established.

According to Kuhl and Fuhrmann's *volition theory* (1998, p. 15), volition can be expressed in two ways. The first mode of volition supporting the maintenance of an active goal is called *self-control* or *action control*. The other mode, supporting the maintenance of one's actions in line with one's integrated self, is called *self-regulation*. Central coordination of processing across a variety of psychological subsystems is the defining characteristic common to either mode of volition. (See also Kuhl 1984, 1992.) When using the term self-regulation in a broader sense, Kuhl and Fuhrmann (1998) mean concurrent satisfaction of a majority of short- and long-term personal needs which represent an integrated self when pursuing a goal.

Self-regulation has been shown to be essential to the learning process (Järvelä and Järvenoja 2011; Zimmerman 2008; see also Kaisvuo 2014). It can help learners in creating better learning habits and strengthening their study skills (Wolters 2011), applying learning strategies to enhance academic outcomes, monitoring their performance (Harris et al. 2005) and evaluate their academic progress (De Bruin et al. 2001). Self-regulation intermediates between cognitive and affective attributes and it involves processes such as setting goals for learning and using effective strategies to organise information to be remembered (Ruohotie 2000, Ruohotie 2003, pp. 251–253). Zimmerman and Schunk (2008) have defined self-regulated learning as the process by which learners personally activate and sustain cognitions, affects and behaviours that are systematically oriented towards the attainment of learning goals. Self-regulated learning skills help to describe the ways how people approach tasks, apply strategies, monitor their performance and interpret the outcomes of their efforts towards achieving specific learning goals. When people have self-regulatory skills, they can modify their performance based on their personal characteristics and environmental conditions (Zimmerman 2000). We agree with Kaplan (2008) that self-regulated learning is not only limited to academic contexts but can occur wherever learning – both formal and informal – takes place.

36.2.1 Phases and Processes of Self-Regulation

The cyclical model of self-regulation includes three general phases: *forethought*, *performance* and *self-reflection* (see Zimmerman 2000; Zimmerman and Campillo 2003; Zimmerman and Moylan 2009; Pintrich and Zusho 2002). According to Zimmerman and Campillo (2003) and Zimmerman and Moylan (2009), during *the*

forethought phase, the person analyses the learning task and set specific goals towards completing that task. Goal-setting is defined as deciding on specific outcomes of learning or performance (Locke and Latham 1990). Beliefs of personal capabilities affect the type of goals that individuals select and their commitment to them (Zimmerman 1995). When individuals feel capable of performing a particular task, they are more likely to set challenging and specific goals (Zimmerman et al. 1992). Encouraging in setting process goals will have both achievement and motivational advantages, because of directing attention to executing the essential aspects of a particular task. Process goals encourage learners to keep track of how well they perform a strategy, evaluate goal progress and judge perceptions of competence (Locke and Latham 1990). Outcomes expectations are beliefs about the success of a given task (Zimmerman 2011). When people learn unfamiliar topics, they may not know the best ways to approach the task or what goals might be the most appropriate.

In *the performance phase*, a person employs strategies to make progress on the learning task and monitor the efficacy of those strategies as well as motivation for continuing progress towards the goals of the task (Zimmerman and Campillo 2003). Self-observation (Schunk 1983; Zimmerman and Paulsen 1995) is a performance control phase process that involves selectively attending to particular aspects of one's behaviour or performance. It is an important process, because it helps learners to discriminate between effective and ineffective performances and helps to isolate the source of error or confusion when one is performing poorly.

In the final *self-reflection phase*, a person evaluates his/her performance on the learning task with respect to the efficacy of the strategies that they chose. During this stage, emotions are managed as the outcomes of the learning experience. These self-reflections influence future planning and goals, initiating the cycle to begin again (Zimmerman and Campillo 2003). Self-efficacy beliefs not only influence the goals people set for themselves but also their evaluative reactions of goal progress (Zimmerman and Bandura 1994). After performing a task or an activity, people will often evaluate or reflect cognitively on the perceived causes of that performance. These causes are termed causal attributions (Zimmerman 2000).

Performance involves self-regulatory processes occurring during motoric efforts and affecting attention and action. Self-reflection includes self-regulatory processes that occur after performance efforts and influence a person's response to that experience. These self-reflections influence forethought processes and beliefs regarding subsequent efforts to learning and completing a self-regulatory feedback cycle (Zimmerman and Cleary 2009, pp. 248–249).

The phases and subprocesses of self-regulation are illustrated in Fig. 36.1. The cyclical model was originally presented by Zimmerman (2000), Zimmerman and Campillo (2003) included the subprocesses and Zimmerman and Moylan (2009) revised the model. The model is grounded in social cognitive theory and it has a focus on the influences on motivation on self-regulation. The cycle is complete when the self-reflection processes influence forethought processes during a subsequent learning attempt. Self-efficacy beliefs exist within this system of self-regulatory beliefs and processes. These beliefs are critical to the forethought phase

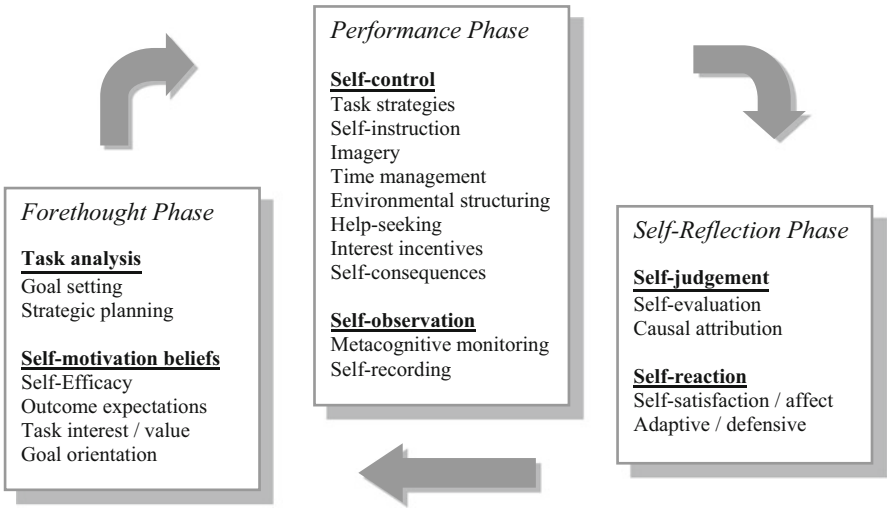

Fig. 36.1 Phases and subprocesses of self-regulation (Adapted from Zimmerman and Moylan 2009, see also Kaisvuo 2014, p. 55)

process, because they can sustain high levels of motivation and resilience in learners when they encounter obstacles or difficulties in learning (Zimmerman and Campillo 2003; see also Zimmerman and Moylan 2009).

36.3 The Relation of Motivation and Self-Regulation

Motivation is a system of self-regulatory mechanisms including selection, activation and sustained direction of behaviour towards certain goals. Individuals motivated to attain a goal are more likely to believe in their capabilities to attain that goal (Bandura 1997). Motivation is the reason which makes people act. Several researchers have suggested that the only thing directly affecting academic achievement is motivation, and all other factors affect achievement only through their effect on motivation (e.g. Tucker et al. 2002, p. 477.) Motivation is primarily concerned with how behaviour is activated and maintained (Bandura 1997). It has been defined by social cognitive researchers as a process in which goal-directed behaviour is instigated and sustained (Pintrich and Schunk 2002). When people are motivated to learn, they are more likely to invest the necessary time and energy needed to learn and apply appropriate self-regulatory skills, and when they are able to successfully employ self-regulation strategies, they are often more motivated to complete learning tasks (Zimmerman 2000). Motivation is an important variable, because it has been consistently associated with academic competence (Linnenbrink and Pintrich 2002).

Many theories distinguish between extrinsic and intrinsic motivation. When individuals are intrinsically motivated, they engage in an activity, because they are interested in the activity and enjoy it. When extrinsically motivated, individuals engage in activities for instrumental or some other reasons, such as receiving a reward (Deci et al. 1999). Also Davis et al. (1989) have clarified that the motivation structure consists of intrinsic and extrinsic motivation. Extrinsic motivation means the process of performing the activity because of the reinforcement value of outcomes. This type of motivation is linked to the perceived usefulness of the action in relation to the outcomes. Intrinsic motivation is the process of performing the activity and the activity is performed, because it is enjoyable.

White (1959, p. 297) was the first to define the term 'competence' in his seminal article as '… an organism's capacity to interact effectively with its environment'. He was also the first one to make a connection between competence and motivation and, more interestingly, to notice that the motivation needed to attain competence was related to how person interacts with his/her environment. Mulder (2014, p. 112) states that '… without performance motivation, or the will to master a certain level of professional skill, there would be no professional learning at all'. However, majority of the research on the effects of environmental events on intrinsic motivation has focused on the issue of autonomy versus control rather than that of competence (Deci 1971). Deci (1971, 1975) has found out that if people are paid to do something, they would otherwise have done out of interest and they will be less likely to do it in future without being paid. There has been some controversy in the literature in the past decade concerning the generality of this effect. Deci later combined with Ryan (Deci and Ryan 1985) to develop *a theory of self-determination* and intrinsic behaviour to explain the suppression effect and to suggest conditions of personal development and purposive behaviour in which it might be avoided.

Deci and his associates (Deci and Ryan 1985; Deci et al. 2001; Ryan and Deci 2000) have put forward *a cognitive evaluation theory* as a part of their self-determination theory to explain the reduction of intrinsic motivation by extrinsic rewards. It has been further elaborated (Ryan and Deci 2000) in ways which point to the same convergence in different approaches as is suggested by the generalisation of cognitive process theory from the micro to the macro level of intrinsic motivation. Events which increase a sense of competence or self-determination will enhance intrinsic motivation, while rewards for taking part in or completing an activity would reduce intrinsic interest by lessening self-determination. However, quality-dependent extrinsic rewards could increase rather than decrease feelings of competence and thus be less likely to suppress intrinsic interest.

Dividing motivation into intrinsic and extrinsic is not completely simple, because extrinsic rewards decrease intrinsic motivation in many situations (Deci 1975). Ryan and Deci (2000) have concluded that extrinsic motivation can vary greatly in its relative autonomy. For example, people who do their work, because they see its value for their chosen future career are extrinsically motivated, as are those who do the work only, because they are adhering to their parents' control. The effects on intrinsic motivation will differ according to whether the extrinsic rewards entail

personal endorsement and a feeling of choice or whether they result from compliance with external regulation.

Zimmerman and Schunk (2008) have provided a foundation about the importance of motivation in the context of self-regulated learning and the challenges of maintaining and self-regulating motivation itself. Both self-regulation and motivation are highly influenced by prior achievement experiences. Self-regulated learners are those who are metacognitively, motivationally and behaviourally active in their own learning processes and in achieving their own goals. Also Warshaw and Davis (1985, p. 214) have identified that motivation encompasses a system of self-regulatory processes that involves selection, activation and sustained behaviour towards goals.

In addition to self-regulation, motivation can have a pivotal impact on academic outcomes (Zimmerman 2008), and it can manifest itself in various forms such as effort, persistence and choice of activities. This hypothesis has been consistently confirmed by researchers over the past few decades (Bandura 1997; Pajares 1996; Schunk and Hanson 1985). When people believe they can perform a task in a proficient manner, they will become more engaged in the activity, work harder and sustain high levels of effort even when obstacles are encountered. In terms of effort, rate of performance and expenditure of energy have typically been employed in research (Zimmerman 1995). Schunk (1985) has used Bandura's theory to render an understanding of what he terms *motivated learning*, which means that motivated learners are pushed to acquire skills and knowledge during activities rather than simply completing the activities.

36.4 The Relation of Self-Regulation and Competence

Traditionally, Finnish education system and working life have been following the policy that focuses on formal qualifications. A work and learning outcomes-based approach have formed the basis of Finnish vocational education and training for a couple of decades. When the national core curriculum of vocational qualifications was reformed in 1993–1994, the former syllabuses, study units and subjects were replaced by vocational study modules and competence-based objectives and assessment criteria that are based on the operational entities of working life. Since those years, the aim of all reforms affecting curricula and competence-based qualification requirements has been to further a learning outcomes-based approach. Current key areas in developing the VET qualification system in Finland include (1) qualifications' and the qualification structure's relevance to work and the ability to react to changes, (2) holistic approach to the qualification system and the clarity of the qualification structure, (3) common approach to structuring qualifications and (4) the flexibility of qualifications and the qualification structure (Finnish National Board of Education 2015).

The concept of competence and various conceptions of professional competence are discussed in an international context in the first chapter of this volume. The

research results of the empirical studies in the current chapter are mostly based on the data collected in the Finnish context of education and working life where the concept of competence refers to individual characteristics that explain the effectiveness or success of tasks and work situations defined by certain criteria (Ruohotie 2005). Occupational competence refers in the Finnish context to the performance potential or ability to perform in professional tasks valued by the organisation (Ruohotie 2005; Heckhausen 2005; Kanfer and Ackerman 2005).

In the Finnish context, Hanhinen (2010) has described working life skills and knowledge using the concepts of *qualification*, *competence* and *vocational proficiency. Vocational proficiency* or *vocational know-how* is realised in a job performance as know-how or ability combining *qualifications* and *competence* (Hanhinen 2010, p. 96). A *qualification* can be defined as a skill and knowledge requirement, set by working life. Similarly, a *competence* is the potential to cope with the demands of the work, based on an individual's cognitive abilities (procedural knowledge, declarative knowledge, intelligence) and affective and conative aptitudes (temperament, emotion, motivation and will) (Hanhinen 2010, p. 96; Ruohotie 2005). Laitinen (2014) has studied the intercultural competence of polytechnic institute teachers. She examines the concept of competence on the basis of Hanhinen's (2010) classification, defining competence as 'a phenomenon, arising as a result of the interaction between hereditary tendencies, the operational environment and an individual's own behaviour based on self-regulation, the maintaining and reproduction as well as the utilisation of which require emotion- and will-based aptitudes' (Laitinen 2014, p. 40). Paloniemi (2006) has also defined vocational competence to broadly cover knowledge, skills, attitudes and aptitudes.

According to Mulder (2014), the different concepts of occupational competence have been helpful in mapping different occupations as well as competence-based learning and its practices. They can also be combined in practice in educational planning. How the different views relate to each other depends on the goal and context of occupational competence.

Due to the different approaches, Le Deist and Winterton (2005) and Winterton (2009) support a more holistic view of competence. A more holistic view allows one to strive towards understanding the concept on more global terms. The fragmentation of the concept has been visible, for example, in the formation of the European qualification framework. Competence was seen as a narrow-ranging concept, and emphasis was given to learning outcomes instead of competence (Winterton 2009). Le Deist and Winterton (2005) and Winterton (2009) have created a holistic classification for competence, which is described in Table 36.1. If the concept of competence is used without qualification, it is used to refer to different dimensions in the context of work. *Cognitive competence* covers knowledge and understanding, and *functional competence* includes skills (i.e. practical know-how). *Social competence* includes the competencies related to behaviour and attitudes. *Metacompetence* differs from the others in the regard that its purpose is to promote the gaining of other competencies.

Zimmerman (1998) discerns six areas in which learners can regulate their behaviour: motives, methods, time consumption, outcomes, physical environment

Table 36.1 A holistic classification of the concept of competence

	Occupational	Personal
Conceptual	Cognitive competence	Metacompetence
Operational	Functional competence	Social competence

Le Deist and Winterton (2005, p. 39)

and social environment. If all of these aspects are determined by someone other than the learner him-/herself, the source of control is external (e.g. supervisors or teachers). Naturally, learning can still take place but self-regulation cannot occur. Especially self-efficacy, an important component of the first (forethought) phase of self-regulation cycle (Zimmerman 2000), has a strong impact on thought, affect, motivation and action. As personal level metacompetence and social competence have both a significant role in competence development (Table 36.1), it is viable to state that self-regulation is related to both of these competencies as it provides basis for purposeful action (Bandura 1991).

According to Gagné (2010), in order to excel, one needs, in addition to deliberate practice (Ericsson et al. 1993), both gifts and ability to keep things under control. Self-regulation plays an important role as an indirect factor between competencies and direct formal, non-formal and informal learning processes (e.g. vocational studies, leisure time activities and work) aimed to develop them. This assumption is supported by international studies in the context of skills competitions, where vocational secondary level students' competition scores are statistically contrasted to their self-reported self-regulatory abilities.

An international comparative study of 38 countries ($N=409$) showed that WorldSkills Competition (WSC) medal winners self-assessed self-regulatory dimensions higher than other competitors. Results of statistical analysis showed that medal winners had the highest self-reported level of extrinsic motivation [$\chi^2(2, 341)=11.080$, $p=.004$], and they also reported the highest average rating for success due to ability [$\chi^2(2, 341)=8.104$, $p=.017$]. Most successful competitors also had higher self-reported levels of volition (perseverance) than other competitors [$\chi^2(2, 342)=8.777$, $p=.012$] (Nokelainen et al. 2012).

Also a study in the Finnish context emphasised the significance of the WSC competitors' ($N=152$) personality traits (e.g. self-regulation) in the development of exceptional vocational talent (Nokelainen 2016). Competitors who were unable to cultivate a strong desire to display their skills (both mastery-approach and performance-approach goal orientations) and, in addition, had difficulty concentrating on the task (performance-avoidance goal orientation) were unable to realise their full potential in competitive situations. The results indicate that the highest-performing competitors have a higher level of perseverance and more effective time management skills (volition) than their lower-achieving peers. Further, competitors who rely heavily on domain-specific external support (teachers, trainers) are most likely to underperform in stressful environments, such as workplaces.

Another study in the context of UK included survey data from 76 vocational education students who participated in training and competitions to be selected for

the WSC UK team (Nokelainen et al. 2013). In parallel with the findings of the previous study, results showed that the most important contributors to vocational excellence were motivational in nature. According to this study, the medal winners seemed to be partly motivated by not wanting to appear incompetent to others (performance-avoidance goal orientation) [$\chi^2(2, 37) = 11.374$, $p = .003$].

36.5 Self-Regulation and Competence in the Context of Working Life: A Case Study of Finnish Air Traffic Controllers

Nokelainen (2016) has constructed a Developmental Model of Vocational Excellence (DMVE) to explore the acquisition of professional and vocational excellence (Fig. 36.2). Relating to the above-discussed concepts of self-regulation and competence, DMVE builds on research into individual attributes and characteristics and the dimensions of intelligence, including Zimmerman's research on self-regulation (Zimmerman 1998, 2000, 2008, 2011), Gagné's research on development of talent (Gagné 2004, 2010), Ericsson's research on development of expertise (Ericsson et al. 1993; Ericsson 2006) and Gardner's research on multiple intelligences (Gardner 1983, 1999).

The model maps the development of competence in terms of cognitive skills and affective abilities (expressed as multiple intelligences domains), work skills, influential individuals and factors related to self-regulation (motivation, volition and self-reflection). Interestingly, a recent review from Dunlosky et al. (2013) confirms a positive relation between self-regulated learning (e.g. time management strategies and self-testing) and learning outcomes. However, we stress here that self-regulation

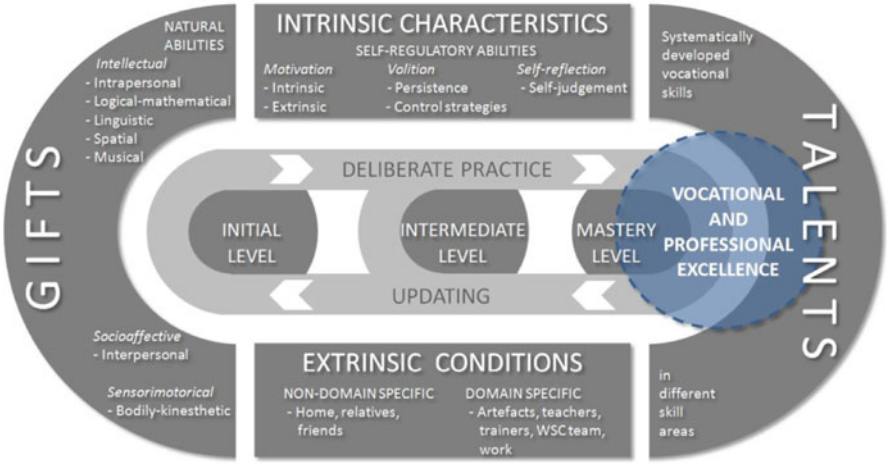

Fig. 36.2 Developmental model of vocational and professional excellence (Nokelainen 2016)

is one aspect of a broader concept of regulatory processes, including also co-regulation and socially shared regulation (e.g. Järvelä and Hadwin 2013).

Empirical findings in the context of WorldSkills Competitions (WSC) emphasised the significance of the WSC competitors' personality traits (especially natural abilities and self-regulation) and external factors (especially support from parents, teachers and trainers) in the development of exceptional vocational talent (Nokelainen 2016). The results indicate that the highest-performing competitors have a higher level of perseverance and more effective time management skills (volition) than do their lower-achieving peers. Further, competitors who rely heavily on domain-specific external support (teachers, trainers) are most likely to underperform in controlled environments, such as competitions.

DMVE has also been applied in the context of workplace learning. Pylväs et al. (2015) used the model to analyse on-the-job performance in the domain of highly skilled and safety-critical vocation of air traffic controller (ATCO). The target population of the Pylväs et al. (2015) study consisted of Finnish ($N = 300$) air traffic controllers of which 28 were interviewed (8 females, 28.6 % and 20 males, 71.4 %). Their average age was 37.9 years ($SD = 38.0$). The study analysed the role of natural abilities (gifts), intrinsic characteristics (self-regulatory abilities) and extrinsic conditions (domain- and non-domain-specific factors) in ATCOs' vocational development (initial interest, perseverance and mastery). Next, we present the research results relating to self-regulatory abilities in ATCO job performance.

ATCOs simultaneously control aircraft taking off and landing and make observations of the work environment with the help of various kinds of information technology equipment (Finavia 2013). In order to understand ATCOs' job profiles, the study began in 2011 by interviewing three key persons (manager, air traffic controller and trainer, HR specialist) who had more than 10 years work experience in the field. A semi-structured interview instrument was developed on the basis of the key personnel interviews and existing research. The interviews of 28 ATCOs were conducted in four Finnish airports. The airports were selected to represent different types of airports and ATCO job profiles in Finland. The research data also included the interviewees' employee assessments.

Due to highly selective entrance tests (Wickens et al. 1997), all operative ATCOs are considered experts in their vocational field. However, the work-related performance of the participants was classified in two levels: 'expertise' and 'excellence'. Individuals, who have performed exceptionally well over a long period of time, represented vocational excellence in this study. A panel of experienced operative superiors evaluated the participants' performance level of expertise ($n = 9$, 32.1 %) and excellence ($n = 17$, 60.7 %). The classification was made on the basis of ATCOs' on-the-job performance. The panel used the following criteria to judge the merits of the participants: (1) safe working (low number of critical incident reports), (2) effective air traffic control (aim at the maximum capacity), (3) overall perception of air traffic services, (4) understanding the guidelines and regulations and (5) self-initiative and commitment. This job performance-related information (missing $n = 2$, 7.1 %) was concealed from the researchers until the content analysis of the interview data was completed. The selection of interviewees within the target units

was random, as the participation in interview sessions was based on their predetermined work shifts.

The qualitative interview data analysis took the form of quantitative and qualitative content analysis. The empirical data was thematically categorised according to the theoretical concepts related to the theoretical models used in the study. The unit of analysis, a meaningful piece of text in the interview transcript (e.g. 'The most important thing is to stay motivated. To be good or even better than before'.), was assigned a code relating to a theoretical concept (e.g. 'intrinsic goal orientation'). Qualitative content analysis was applied to examine latent and more context-dependent meanings (Schreier 2014) in the data. A specific technique, Bayesian Classification Modelling (BCM, see Nokelainen 2008), was used to select the most probable predictors of vocational excellence and to increase the research validity of qualitative methods in a confirmatory way. The input data matrix for BCM contained the following variables: 12 characteristics (such as 'intrinsic goal orientation', 'volition' and 'control beliefs', 'job performance', 'entrance examination success' and 'study success'). The numerical values for the 12-characteristic variables were based on the code frequencies (later referred to '$n_{\text{categories}}$') from the preceding theoretical concept analysis.

The findings of this study are in parallel with earlier research related to vocational excellence (Nokelainen et al. 2013; Nokelainen 2016). All participants recognised cognitive skills (logical-mathematical skills, problem-solving skills, perceptive skills, learning skills, simultaneous skills), self-reflection (control beliefs, stress tolerance), volition (perseverance and determination, exactness and carefulness, ability to concentrate, time management skills) and goal orientation (extrinsic and intrinsic motivational factors) as the most important characteristics in vocational expertise of air traffic controller. Interpersonal skills (social skills), intrapersonal skills (ability to understand and analyse one's own performance) and spatial skills (conceptual understanding of three-dimensional information) were also among the acknowledged characteristics in this specific vocational field. However, the main differences between the ATCOs representing vocational expertise and those representing vocational excellence were related to self-regulation. Particularly, goal orientation and volition proved to be stronger among the employees representing vocational excellence.

Both qualitative and Bayesian analyses illustrated that the employees representing vocational excellence had a stronger (particularly intrinsic) goal orientation than the employees representing vocational expertise. Intrinsic goal orientation ($n_{\text{categories}}=48$, 15.1 %) was linked to individual ambition as well as strong interest in air traffic control and aviation. Extrinsic goal orientation ($n_{\text{categories}}=44$, 13.8 %) consisted of various factors such as professional benefits (working hours, salary), professional status and professional responsibility. Volition ($n_{\text{categories}}=46$, 14.5 %) was also considered as one of ATCOs' most important vocational characteristics. Concentrating on the work requires not only volition and sustainability but also the ability to regulate attention from peak to quiet traffic periods. Determination and perseverance is needed in problem-solving and decision-making as air traffic controller needs to be able to trust one's own skills in any circumstances. In addition,

ATCOs' work requires exactness, carefulness and time management skills in order to meet the official requirements of air traffic control. In the interviews, volitional differences between the ATCOs were related to exactness, carefulness and time management skills. In Bayesian analysis, volition appeared slightly higher among the employees representing vocational excellence.

The theoretical framework with relation to self-reflection included control beliefs and stress tolerance. Success in working life was more often seen as a result of one's efforts (control beliefs, $n_{\text{categories}} = 24$, 7.5 %) than as a result of one's abilities (efficacy beliefs, $n_{\text{categories}} = 8$, 2.5 %). Active self-reflecting and practicing, leading to vocational routines, were considered to increase the potential for success in working life. However, unsuccessful performance was more often seen as a result of difficult circumstances (bad weather, non-functioning equipment, etc.) than under one's own control. Based on the results of Bayesian analysis, attribution interpretations turned out to be one of the main differences between the employees representing vocational expertise and those representing excellence. The ATCOs representing vocational expertise emphasised the significance of effort for success during the training period and the importance of abilities for success in working life. The ATCOs representing vocational excellence did not see effort as having a big role in training success. Furthermore, they did not stress the importance of effort or ability during working life. Stress tolerance and regulation, calmness and good nerves, in particular, were considered vital characteristics in ATCOs' work. The interviewees underlined the importance of resistance to pressure in decision-making: the ability to make quick decisions and take the responsibility for the decisions. An important part of ATCOs' work is to be able to mentally process the stress after unsuccessful performances.

36.6 Conclusions

In this chapter, we have discussed the concepts of self-regulation and competence in the context of workplace learning. Research indicates that self-regulative abilities enable professionals to be effective lifelong learners (e.g. Pintrich and De Groot 1990; Schunk and Zimmerman 1994). Improving perceptions of personal control leads to the strengthening of intrinsic motivation, the improvement of learning outcomes and the development of responsibility and a sense of self-efficacy (Nokelainen 2008). We argue that self-regulation plays an important role in the development of competence, as it is needed to acquire competencies, unified sets of knowledge, skills and views (see Mulder 2014).

Learning is most natural and effective when it is experienced as meaningful and relevant and when the learning environment supports the learning and encourages self-regulation and self-control. According to Zimmerman (1994), self-regulation is only possible in a context that allows people to make their own choices and be in control. If learners are not given the opportunity to exercise control and the freedom

to choose their own strategies, they will not learn to regulate their own behaviour, and they will not develop enthusiasm for taking initiative.

Results of several studies on self-regulation and competence in the context of vocational skills competitions (Nokelainen et al. 2012; Nokelainen et al. 2013; Nokelainen 2016) and air traffic controllers work (Pylväs et al. 2015) indicate that greater account may need to be taken of the significance of self-regulatory skills in addition to vocation-specific skills. Both vocational and professional education students and professionals are assumed to be aware of the potential usefulness of self-regulation processes, but they also need motivation to self-regulate (e.g. Zimmerman 2001). Therefore, workplaces as well as vocational and professional education learning environments should be designed in a way that they offer possibilities for choice, challenge, collaboration, making meaning, taking initiative in one's actions and receiving constructive feedback and rewards.

According to Nokelainen (2016), characteristics of vocational talent development are controllable and, thus, manageable through educational policies: (1) attributing success mainly to uncontrollable instead of controllable factors, (2) using maladaptive instead of adaptive patterns of learning and (3) focusing on the self instead of focusing on the task. He suggests that on individual level, focused mental training in these areas (i.e. courses focusing on 'soft skills') may improve the match between vocational education and working life requirements. Practical examples of such courses are the ones that develop skills related to self-concept (social skills, conflict management; emotions, understanding different cultures; actions, explanations for success and failure).

At an institutional level, the findings of abovementioned studies provide educational institutions with strategies to improve vocational teacher education and authorities to further develop vocational education curriculum. For example, in the Finnish context, the research has supported the development of vocational teacher training seminars, instructional material and expert networks. The research also points to ways in which the quality and relevance of vocational outcomes can be enhanced by offering vocational education students opportunities to develop the attributes and characteristics associated with excellence.

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Chapter 37
Fostering Development of Work Competencies and Motivation via Gamification

Michael Sailer, Jan Hense, Heinz Mandl, and Markus Klevers

37.1 Introduction

Depending on the task and context, games and game-based environments can outclass traditional training settings regarding work competence development. The effectiveness of such environments has been demonstrated in different work contexts, for example, pilot training. In a study by Gopher et al. (1994), flight students who engaged in a game-based simulator outperformed students within a traditional training regarding their flight performance. Further results in the context of submarine training programs support the effectiveness of game-based training environments by showing improved performance and higher motivation when applying a game-based training (Garris et al. 2002; Garris and Ahlers 2001). Also in the context of medical education, game-based trainings and computer game usage are positively correlated with surgical skills of medical students (Rosser et al. 2007).

Games and game-based learning concepts are promising methods for the successful design of training environments and the development of work competencies. A major potential of such game-based environments is their motivational power, which can affect learning outcomes as well.

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The development of new work competencies or the further development of existing work competencies seems to be traditionally connected to off-the-job training and professional development. But recent approaches focus on the potentials of the workplace itself to learn and develop competencies. These workplace learning approaches meet a number of current challenges concerning the qualification of staff better than off-the-job learning (Illeris 2011). While the workplace is a place to work and perform, it can also offer opportunities to develop competencies by providing work conditions, which stimulate and support learning (Ellström 2011). A major advantage of such approaches is to learn with authentic problems and enable transfer of learning.

Gamification is a relatively new and innovative approach to stimulate and support learning while ensuring motivation and transfer. The central idea of gamification is to use the motivating power of games for non-gaming purposes in real-life contexts. In the context of the development of work competencies, gamification can take advantage of both game-based learning approaches and on-the-job training. It combines the motivating power of game design elements from games and the learning potential of the workplace itself.

This chapter will illustrate how gamification can be applied at work and how it effects the development of work competencies and motivation. A gamification case example in the field of intralogistics shows a possible implementation of gamification. An empirical investigation of that case example will provide insights about effects of gamification.

In section 2, competence models and strategies to develop work competencies will be investigated, and the role of motivation will be discussed. In section 3, the concept of gamification will be introduced, and its possible effects on competence development and motivation will be discussed. In section 4, a case example in the field of intralogistics including empirical findings from an experimental study will be presented. Section 5 will conclude with a discussion of the potential of gamification for the development of work competencies and its theoretical and practical implications.

37.2 Competence and Motivation in the Workplace

Competencies can be described as “the latent cognitive and affective-motivational underpinning of domain-specific performance in varying situations” (Blömeke et al. 2015, p. 3). Consequently competence is a complex construct consisting of cognition and affect-motivation, which give rise to observed behaviour (Blömeke et al. 2015).

In the workplace context, work competence can be defined as a learned ability to adequately perform a task, role or mission (Roe 2002). As performance is the basis of organisational success, this definition emphasises the role of performance within a workplace setting. Staff competencies are therefore essential to enhance organisational performance. However, competencies themselves are not sufficient to perform

a work task. To actually apply work competencies and thereby develop new competencies and cultivate existing ones, learners need to be motivated. Motivation refers to those psychological processes that are responsible for initiating and continuing goal-directed behaviours (Schunk et al. 2010). It can be seen as an individual factor that seems to play a role in the development of competencies in the workplace (Bartram and Roe 2008).

As competencies and motivational action tendencies have a close relation to each other (Weinert 2001), an approach to foster both competence development and motivation in the workplace will be described later on. Firstly, competence models and approaches to foster competence development will be presented in section 2.1. Secondly, perspectives on motivation will be analysed in section 2.2.

37.2.1 Competence Models and the Development of Work Competencies

What are central work competencies? There are different approaches to answer that question. Some authors specify core competencies, which include soft competencies, such as teamwork and cooperation, customer service orientation or self-confidence, and hard competencies, such as technical expertise and conceptual thinking (Spencer and Spencer 2008; Rainsbury et al. 2002).

The problem with such lists, which include specific work competencies, is that they are not necessarily generally transferable to all work contexts. For this reason, another strategy is to compile a competence model based on the needs of a specific organisation. These organisation-specific competence models identify the competencies needed to operate within a specific job. Such behavioural job descriptions have to be defined for each function and each job (Fogg 1999).

A further strategy is to provide global sets of competencies and systematise them within taxonomies. These resulting models are described as common competence models. Within such models, categories of competencies are defined and complemented with subcategories on different levels. For example, the "KODE®-Kompetenzatlas" postulates four classes of key competencies: (1) *personal competence*, (2) *activity and action competence*, (3) *social-communicative competence* and (4) *professional expertise and methodological competence* (Erpenbeck and Heyse 2007). Within every key competence class, subtypes and subgroups consisting of 64 competence groups are defined. This competence model helps to assess competencies as well as self-evaluate ones' own competencies (Bäcker and Zawacki-Richter 2011).

As these approaches in the field of competencies are very diverse, it is difficult to discern a coherent theory or framework for competencies (Weinert 2001). Despite their diversity, all work competencies have in common that they describe conditions for success in meeting tasks, goals and success criteria in the field of action (Weinert 2001; Roe 2002).

As work competencies are action-orientated, promising approaches for developing work competencies, while ensuring transfer and relevance for practice, are work-oriented learning approaches. Here work-related and work-integrated learning approaches can be differentiated. In both cases, the workplace itself plays a major role. Work-*related* learning refers to competence development in authentic learning environments, while work-*integrated* learning refers to competence development directly at the workplace (Sonntag and Stegmaier 2007). The development of work competencies by work-integrated learning approaches helps to foster transfer, as learning is taking place directly at the workplace. Another advantage is the direct application of newly acquired or further developed competencies in authentic work environments. Especially for new staff, this approach is suitable to foster integration and learning processes.

37.2.2 Motivation as a Facilitator for the Application of Competencies

Motivation is important for performance and thereby should be involved in the concept of competencies as well (Blömeke et al. 2015). Therefore, it will be discussed as a component of work competencies.

The development of work competencies is of little use if they are not applied at the workplace or, in other words, if training transfer fails. Research has demonstrated that a number of factors are influential when it comes to training transfer. The classic model established by Baldwin and Ford (1988; Blume et al. 2010) differentiates influences on three levels; *training design*, *work environment* and *learner characteristics*, with motivation being one of the most important influences on the learners' level. Meta-analyses have shown that a number of motivational constructs, such as self-efficacy or locus of control, influence training transfer and, subsequently, performance at work (Colquitt et al. 2000).

On a general level, motivation can be understood to include those processes which initiate and maintain goal-directed behaviour (Schunk et al. 2010). In the workplace, where behaviour refers to the application or transfer of competencies, workplace conditions play an important role in fostering or inhibiting motivation. Studies have shown, for example, that support by colleagues or a general transfer-friendly climate can support transfer motivation (cf. Kontoghiorghes 2004).

Many different theoretical perspectives have been used to study motivation; among them are behaviourism, cognitive and social-cognitive learning theory (cf. Sailer et al. 2013). The self-determination theory of motivation (Ryan and Deci 2000; Deci and Ryan 2000) can serve as a general framework to underline the basic conditions for enabling (or inhibiting) motivation at the workplace and in other contexts. This framework postulates that three elementary needs have to be met for humans to become motivated: competence, autonomy and relatedness. Competence denotes experiencing that one is able to master a task or a situation (White 1959;

Vansteenkiste and Ryan 2013).; autonomy refers to the degree of individuals' behaviour being free from external control and in accordance with ones' own interests (Vansteenkiste et al. 2010, 2012; van den Broeck et al. 2010); relatedness refers to the need to belong to others and to be connected with them (Baumeister and Leary 1995; Deci and Ryan 1985). Accordingly, workplace and transfer motivation should generally profit from fostering feelings of competence, allowing for autonomy and supporting relatedness at the workplace.

37.3 Gamification as an Innovative Approach for Work-Integrated Learning

Gamification is an approach which can be used to support competence development and motivation. It can be described as an innovative concept to foster motivation, engagement, learning or problem-solving activities in non-gaming, real-world contexts (Kapp 2012). The basic idea of gamification is to apply game design elements in non-game contexts (Deterding et al. 2011b). Thereby gamification can be a work-integrated approach to foster competence development and motivation. The term gamification originates from the digital media industry. Although the term has been used as early as 2002 (Marczewski 2013), it did not receive broader attention until 2010 (Deterding et al. 2011a). At that time, it was mostly used in the context of marketing but quickly began to spread to other contexts including education (Kapp 2012) and business (Werbach and Hunter 2012). However, the idea of gamification is not a new one. Collecting virtual currencies in the form of so-called air miles in the airline industry and gaining a level-up like a silver or gold status in the context of credit cards are examples of game design elements in non-game contexts which everybody knows from everyday life (cf. Zichermann and Cunningham 2011; Nelson 2012; Seaborn and Fels 2015).

In Sect. 3.1, the concept of gamification will be discussed in detail. In Sect. 3.2 the focus will be on the core components of gamification. Next the question as to how gamification can help to support competence development and foster motivation will be answered in Sect. 3.3 and Sect. 3.4.

37.3.1 Gamification and Its Underlying Concept

Defining the term gamification reveals the main components which belong to its concept: Gamification is "the use of game design elements in non-game contexts" (Deterding et al. 2011a, p. 1). In this definition, the terms *game*, *element*, *design* and *non-game context* are central.

Games can be classified along a continuum with two endpoints. Caillois (1961) describes the endpoints with the terms *ludus* and *paidia*. The term *game* relates to

the category of *ludus* and characterises rule-based playing with determined goals (Groh 2012) and quantifiable outcome (Salen and Zimmerman 2004). The counterpart of *ludus* is *paidia*, which refers to free, unstructured and improvisational behaviours. These behaviours can be summarised under the term *play* (Caillois 1961). Although gamification focuses on gaming activities, these activities can also include forms of play, depending on the behaviour of the person interacting with the gamification system. Due to its primary attention in media and human-computer interaction literature, the focus of gamification systems seems to be on elements from digital games. This can be seen as an unnecessary restriction (Deterding et al. 2011b), as game design elements from all forms of games – digital and nondigital – are possible.

The term *element* in above-mentioned definition refers to the fact that gamification does not constitute complete games. In contrast to computer games, board games or serious games, gamification just uses parts of these. This blurry boundary between full games and gamification can be seen as a subjective, personal and social boundary (Deterding et al. 2011b). It is a process of negotiating how someone acts and behaves within a gamification system. The experience and interaction can be more or less playful and is thereby seen as a more or less holistic gaming experience.

Gamification refers to game *design* elements used in non-game contexts instead of other elements which belong to a wider game ecology (Deterding et al. 2011a). Examples of elements which belong to the game ecology, but which are not game design elements, are game controllers or graphic engines. Such elements could also possibly be used in non-game contexts, but do not necessarily constitute a gamification environment. Depending on their level of abstraction, game design elements can be interface design patterns, game mechanics, design principles, game models or game design methods (Deterding et al. 2011a).

The above-mentioned game design elements are implemented in a *non-game context*. There is no restriction as to the details of this context. Exemplary contexts, in which gamification systems have already been applied and investigated, are schools (Goehle 2013), universities (Kumar and Khurana 2012; Domínguez et al. 2013), production environments (Castellani et al. 2013), enterprise businesses (Hate 2013; Jung et al. 2010), healthcare (Ahola et al. 2013; Jones et al. 2014) and more specific activities like driving cars (Diewald et al. 2014) or filling in online surveys (Downes-Le Guin et al. 2012; Rapp et al. 2013).

Gamification can also be differentiated by the goals pursued. Gamification has been investigated in respect of the following goals it is supposed to fulfil: fostering motivation (Hense et al. 2014; Gears and Braun 2013; Hakulinen et al. 2013), increasing engagement (Reeves et al. 2011; Barata et al. 2013a; Muntean 2011), increasing well-being (Oprescu et al. 2014), enhancing participation (Vassileva 2012; Barata et al. 2013b), fostering learning (Cheong et al. 2013) and fostering collaboration and interaction (Raftopoulos and Walz 2013; Jung et al. 2010; Fernandes et al. 2012).

In a nutshell, gamification systems can be categorised by the *context* in which they are implemented, by the *goals* they aim to achieve and by the *target group* they

address. One differentiation, which focuses on the target group of gamification and originates from the business field, is the distinction between internal, external and behaviour-change gamification. Here, the questions of who will be addressed and who will benefit from the gamification system are relevant. In *internal gamification*, the target group is already part of a given community, like a company someone is working for. *External gamification*, on the other hand, involves customers or prospective customers outside a company. *Behaviour-change gamification* focuses on changing behaviour for the good, no matter in which context. While in internal and external gamification the organisation's goals are primary, *behaviour-change gamification* focuses on personal benefits of individuals (Werbach and Hunter 2012).

Speaking of the development and application of work competencies, internal gamification is relevant. As gamification is implemented directly at work, it can also be understood as a work-integrated approach for the development and application of work competencies. Work-integrated approaches for learning are characterised by their proximity to the workplace and their supporting effects for transfer and learning (cf. Sonntag and Stegmaier 2007). As gamification is about integrating game design elements into the workflow, thereby fostering the development and application of competencies, this internal gamification approach focuses on the social contextual conditions of the workplace. These social contextual conditions in the workplace are significant for motivation (cf. Deci and Ryan 2012) and thereby for the development and application of competencies.

37.3.2 Game Design Elements: The Core Components of Gamification

After this detailed look into the concept of gamification, the focus of this section will be on concrete gamification systems. In particular, game design elements, which constitute these environments, will be analysed. Two examples from practice might help to illustrate how such game design elements could possibly look.

The *Bottle Bank Arcade Machine*, which was developed in the context of the Volkswagen initiative *the fun theory* (c.f. www.thefuntheory.com), aims at fostering consumers' recycling behaviour by making recycling of glass more fun (de Valk et al. 2012). A bottle bank was transformed into an arcade machine with a display and several holes with lights on top of them. When the lights switch on, the players have to throw their glass in the corresponding hole. The players receive points for this, which are directly fed back on the display. Obviously, the quite simple idea of symbolically rewarding certain behaviours with points constitutes a game design element. In addition, the immediate feedback of the display is a typical game design element. Depending on the playing behaviour, the experience can become social and competitive, which is a crucial part of some games, too.

Another example, but with a different choice of game design elements, is *Zombies Run!* (c.f. www.zombiesrungame.com). This smartphone application

gamifies jogging by adding a story to the running experience. To start the game, players must plug headphones into their smartphone, select a mission in the application and go for a run outside (Southerton 2013). During running, players hear a catchy and fictional story about a zombie invasion, from which the listener has to escape by running. If the escape from single zombie attacks fails, it will result in the loss of potentially valuable supplies, which can be collected for the players' base. The base has to be protected from zombies as well and resources help to defend the base. Within that gamification application, the story plays a central role. That element is also very crucial to many other games and can be seen as a game design element. Further elements are the resource system that accompanies resource management, which is also very widespread in the context of board games or strategy games.

From an analytical perspective, these game design elements are the core components of gamification environments. Attempts to create lists, taxonomies and category systems of such elements have been made by different authors (cf. Werbach and Hunter 2012; Robinson and Bellotti 2013; Kapp 2012; Zichermann and Cunningham 2011). They use different approaches to structure game design elements and to convey an impression of what shape these elements take. One approach is to create liberal sets of elements found in any game. Lists like that do, however, tend to trivialise the phenomenon and to get lost in endless lists of elements. Another approach is to provide a constrained set of elements, which are unique to specific games. By providing lists of game design elements which are characteristic to most games and which play an important role in gameplay, there is an attempt to meet both approaches (Deterding et al. 2011a; Werbach and Hunter 2012). Nevertheless, this choice of elements is a subjective one. Besides the approach of listing game design elements, another approach is to structure the elements by certain functions or their level of abstraction.

It is worthwhile to discuss three of these approaches that aim to structure game design elements in more detail.

Werbach and Hunter (2012) start with a triad of points, badges and leaderboards which they describe as typical game design elements within gamification. Based on that, they propose the categories *dynamics*, *mechanics* and *components* which refer to the level of abstraction of game design elements. They present these categories as a hierarchy; every component is tied to one or more mechanisms, and every mechanism is tied to one or more dynamics which represent the highest level of abstraction (Werbach and Hunter 2012). To give an example, levels (component) provide the player with feedback (mechanism) and create a sense of progression (dynamic). Within these categories, exemplary non-exhaustive lists of game design elements are included. This differentiation works well at first sight, but boundaries between those categories can become blurred in some cases.

Robinson and Bellotti (2013) provide six elaborated and detailed categories referring to the content or functions of different elements. The category g*eneral framing* refers to the content of a gamified system or a story framework. *General rules and performance framing* are main activities which have to be executed, like reaching the top of a leaderboard. *Social features* include relationships or

interactions. *Incentives* can be intrinsic, such as a challenge within a game, or extrinsic, such as a lottery. *Resources and constraints* are bounds within which the player has to operate. Finally, *feedback and status information* provide the player with visual or auditory information about what is going on, what they must do next or what has been achieved (Robinson and Bellotti 2013). These categories can be applied to different game design elements in different non-game contexts.

Kapp (2012) presents a list of common elements, which contribute to gameplay. These involve elements like *goals, rules, conflict, competition, cooperation, time, reward structures, feedback, levels, storytelling* and *aesthetics.* Besides that, these elements are completed by characteristics of games, such as the fact that they are *abstractions of concepts and reality*, that they have a *curve of interest* and that they can be *replayed*. These elements and characteristics are located at different abstraction levels and in different categories. They are elements which can be found in most games (Kapp 2012).

All three attempts should help to give an impression of how varied game design elements can possibly look like and how one can structure them, but they should be understood as non-exhaustive lists of game design elements. From a functional perspective, a single element does not necessarily lead to a successfully functioning gamified environment. It is the interaction between different elements which constitute powerful gamification environments (Kapp 2012). Furthermore the process of implementation of these game design elements plays a major role (Werbach 2014).

To examine gamification in the work context, a closer investigation of a selection of game design elements is necessary. These seven selected elements are crucial in many games and become relevant for the implementation of game design elements in the work context in order to foster the application and development of work competencies. Again, this selection does not claim to be exhaustive:

Points are very basic game design elements. They can be accumulated for certain activities, as in the above-mentioned gamified bottle bank (Werbach and Hunter 2012, 2015; Zichermann and Cunningham 2011).

Badges are visual representations of achievements which can be collected during play. They are awarded to players for certain activities, usually for fulfilling certain steps towards a goal or reaching a certain benchmark (Anderson et al. 2013; Antin and Churchill 2011).

Leaderboards are lists of all the players, usually ranked by their success (Costa et al. 2013). These boards can be individual leaderboards which compare results of single players or team leaderboards which compare teams with each other.

Performance graphs visualise players' performance parameters over time and compare them with previously achieved results (Günthner et al. 2015). Possible parameters are in-game results like points but also work results like the quantity of processed orders or errors.

Meaningful stories provide a framework for gamification environments (Sailer 2016). Stories can be introduced in a tutorial or enfold during game play. They are more or less present during the interaction with the environment. The above-mentioned application *Zombies Run!* is an example of a story which is elementary for the application.

Avatars are visual representations a player can choose within gamification. Avatars can be either simple and static or complex and modifiable (Werbach and Hunter 2015). Depending on the elaboration of the avatar system, the following game design element, which is more abstract, becomes relevant.

Profile development refers to the development of avatars and attitudes belonging to such avatars. The players can hereby adjust their chosen avatar and develop it throughout the gamified experience.

Within the next two sections, the effects of this selection of game design elements will be theoretically investigated. Section 3.3 focuses on effects on work competence development, while section 3.4 focuses on motivation.

37.3.3 How Gamification Helps to Develop Work Competencies

Work-integrated learning approaches are promising approaches for developing work competencies directly on the job (Sonntag and Stegmaier 2007). Gamification can be seen as such a work-integrated approach, which focuses on the social contextual conditions of the workplace.

The central idea for fostering competence development within a gamification environment is to link job-relevant competencies with game design elements and to transpose these competencies on the game level. For example, an elaborated avatar and attribute system could help to focus workers' attention and efforts on specific aspects of the game. These attributes can reflect or express certain competencies or requirements for the development of certain competencies. Badge systems can work in a similar way as they can be awarded for certain steps, a worker takes within a gamified system. These steps or goals can be linked with steps in the development of certain competencies as well. Furthermore such goal setting function can be helpful in regard of motivation (Schunk et al. 2010).

Another important job-related factor, which is likely to have a strong impact on the application and development of competencies, is feedback (Ellström and Kock 2008; Ellström 2006). In the workplace, feedback loops usually take place after certain events and thereby feedback loops are slow. Gamification environments are potent feedback systems, which have the advantage of providing feedback immediately (Stampfl 2012). Points are one very simple way of providing performance feedback on the job.

A more sophisticated possibility to provide content-based feedback is to implement performance graphs, which represent the relevant benchmarks for performance and the needed competencies over time. Such graphs can help to indicate potentials for improvements and provide an overview of one's performance. By doing so, workers can indicate errors or performance fluctuations just in time. This helps to increase the awareness for the workers' own competence development processes and to intervene by changing inadequate or inexpedient behaviour. Furthermore feedback based on the workers' own performance over time can help to foster mastery orientation, which is positively related with competence development (cf. Nicholls 1984; Dweck 1986).

Choosing the relevant dimensions of such feedback systems should be aligned with an existing competence profile, which describes necessary work competencies of the related position. Accordingly, the needed competencies become transparent for staff, and the progress regarding each work competence becomes visible.

Regarding transfer of competencies from learning to working situations, gamification provides a suitable solution as the learning and working environment are identical. Especially for the training of new staff, interactive on-the-job trainings in form of a tutorial with an integrated story are reasonable approaches to develop competencies needed for the corresponding position, while ensuring transfer.

Besides the potential of gamification to develop competencies, it also targets the motivation of staff in the workplace. The next section discusses the motivational power of gamification from a theoretical perspective.

37.3.4 How Gamification Helps to Foster Motivation

Many authors promoting gamification, or related approaches such as serious gaming or game-based learning, suppose that these approaches have an inherent potential to foster motivation for learning and performance (e.g. Gee 2007). However, to substantiate such claims from a theoretical perspective, it is required to show how game design elements relate to specific mechanisms known to be influential in fostering motivation. Drawing on the self-determination theory of motivation (Ryan and Deci 2000; Deci and Ryan 2000), the potential of the above-described exemplary game design elements to address an individual's need for competence, autonomy or relatedness will be analysed.

- The need which can probably be addressed most easily by game design elements is the need for *competence*. Feelings of competence are associated with feelings of success and effectiveness (White 1959; Ryan et al. 2006; Rigby and Ryan 2011). Points, badges, leaderboards and performance graphs all have in common that they communicate and visualise success and progress. Each point won, each badge earned, each place gained on a leaderboard and each positive trend in a performance graph signals success in a previous task. It can be speculated that points and badges are most effective in this regard, as they can usually only signal success, while leaderboards and performance graphs can also signal failure. It has to be noted though that points or badges only serve as a means of feedback on a task and that the realisation to have mastered a task is the true source of feeling competent, not the simple increase of a number. This is why some gamification examples are rightfully labelled as "pointification" and have little potential for enduring motivational effects.
- Game design elements can also potentially evoke feelings of *autonomy*. Feelings of autonomy refer to psychological freedom and feelings of volition to execute a certain task (Vansteenkiste et al. 2010, 2012 ; van den Broeck et al. 2010; Rigby and Ryan 2011). In other words, autonomy can be expressed by the feeling of decision freedom and the feeling of doing something personal meaningful.

Decision freedom can be addressed by choices. Badges can represent different kinds of specialisation (e.g. speed and accuracy) and thus offer the freedom to prefer one specialisation over another. Avatars are another simple way of providing freedom of choice and self-expression, which remains visible throughout a game. Profile development is a more complex option for providing autonomy, as a virtual character can be improved and shaped to one's own liking throughout the life cycle of a gamification application. Besides that, feelings of *task meaningfulness* can be fostered by providing a meaningful story framework within a narrative.

- *Relatedness*, the third elemental human need postulated by self-determination theory, is probably the most difficult to foster by single game design elements. However, stories and narratives might be used to establish a social context and instil the fantasy of the player belonging to a collective. Certain badges may also express slight degrees of relatedness, e.g. as they communicate that one belongs to an "elite" group of accomplished players. The idea of using team leaderboards and referring to a group of players as a team is another promising strategy to create feelings of social relatedness. In case of relatedness, it is the interaction of several elements, which provoke feelings of being socially embedded.

This analysis of selected gamification elements in relation to one influential motivation theory, the self-determination theory, serves to illustrate two arguments. Firstly, it can be shown theoretically how specific gamification elements might trigger specific motivational mechanisms and that such mechanisms might be addressed by more than one element at a time. Secondly, it is quickly apparent that certain gamification elements seem to be able to simultaneously trigger a number of mechanisms, while others only have a singular influence. Badges, for example, seem to be able to address the need for competence, autonomy and relatedness at the same time to some degree, while performance graphs can only address one need, which is the competence need.

However, by looking at other possible motivational mechanisms, stories, for example, can serve to arouse interest or evoke positive emotions. It might be a rewarding effort, which is beyond the scope of this chapter, to conduct a more complete analysis matching game design elements with possible motivation mechanisms derived from other theoretical backgrounds (cf. Sailer et al. 2013).

37.4 A Gamification Prototype for the Development of Work Competencies of New Staff in Intralogistics

To further illustrate the notion of fostering competence development and motivation at the workplace with gamification, an experimental study conducted in the context of intralogistics will be presented. A prototype gamification environment was designed to gamify training and manual work processes. For this, a central intralogistics process was chosen as the examined work context, which is manual

order-picking. To understand why order-picking is the object of choice for this experimental study, it is crucial to understand the whole work environment and its classification in the in-plant material flow.

37.4.1 Gamification of Order-Picking

Order-picking, as one of the most important in-plant intralogistic process, refers to collecting parts from a warehouse to fulfil customers' orders (Arnold 2006). Intralogistics itself is concerned with the internal handling of materials and supplies within specific production sites (Arnold 2006). Intralogistics refers to so-called indirect or secondary range of processes in the production system. Indirect, in contrast to direct or primary processes, are all tasks in a production chain that do not add direct value to the product (Blecker and Friedrich 2005). That is why they are mostly not in focus of companies' *Continuous Improvement Process* (Bakerjian et al. 1993). The result is a work environment that is in most cases neither very stimulating nor motivating. Furthermore the development of work competencies for staff is lacking concepts and structures. Another aspect that has to be taken in account is that almost every task related to intralogistics does not require a high level of qualification. Exemplary tasks are taking products off a shelf, driving a fork-lift or carrying a box from A to B (Arnold 2006). Since these tasks are monotonous and repetitive, they result in high rates of fluctuation of unskilled low paid employees. This high fluctuation raises the need for a structured and elaborated development of work competencies of new staff. In practice, new staff members usually follow a senior employee for one or two days. Afterwards, they start their daily routine. Guidelines or concepts for that training phase do not exist.

Within order-picking a customer can be an end consumer within retail companies or a production process in the in-plant material flow (Feld 2000). Production processes usually run on a very tight schedule, because in modern material-flow-oriented production systems, there is only a very small buffer for pre-products between production steps (or even none at all). So, if material is missing for one process, the whole interlinked production will come to a standstill (Takeda 2006). This time pressure is equally applicable to the order-picking processes, which need to deliver the right set of materials at exactly the right time (Cheng and Podolsky 2008).

The prototype gamification environment, which has been developed, should help to counteract these problems. On one hand, the environment supports the development of work competencies required for the job and on-boarding of new staff. On the other hand, the gamification environment should help to foster motivation of employees in this monotonous and non-stimulating work environment.

To gamify the task of order-picking, the central work process itself has to stay the same. Every active interaction with the gamification environment has to take place either between a sequence of process steps during breaks or during a process step itself. Additional interaction was barred from the beginning so as to not create even more time pressure on the employees. Skipping the details, the normal workflow of

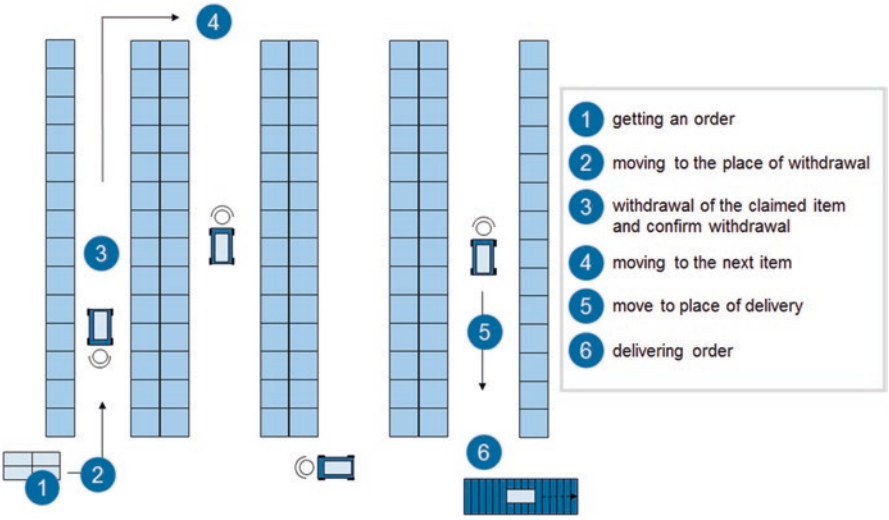

Fig. 37.1 Order-picking work flow

such an environment consists of six major process steps: *getting an order*, *moving to the place of withdrawal*, *withdrawal of the claimed item* (repeat, until the last item of the order has been picked), *confirm withdrawal*, *move to place of delivery* and *delivering order* (ten Hompel et al. 2011) Fig. (37.1).

The steps of getting an order, confirming withdrawal and delivering order usually come along with communication between the order-picker and the system landscape. In most cases, the order is sent to a handheld device on which it gets displayed for the employee. The order-pickers then take the handhelds with them and scan barcodes to confirm every item of the order list. When delivering the order, the system gets a fulfilment notice to know that the employee is ready for the next order. These already existing interactions between the order-picker and the system were used for the interaction between the order-picker and the gamification environment. They are used to calculate each employee's points.

The chosen game design elements to be implemented in the work context are the above-described elements: *points*, *badges*, *leaderboards*, *performance graphs*, *avatars* and *profile development*. They were combined in a *story*, which represents a virtual order-picking league.

At the beginning, order-pickers create their own avatars on a computer station choosing from six different characters, which differ in their attributes. In total there are three attributes, namely, *speed*, *strength* and *accuracy*, and these are linked to the three major operating numbers in order-picking: *picking time*, *number of picks* and *picking errors*. The attributes work as multipliers to gain points. The faster order-pickers finish their orders, the more points they get through the attribute *speed*; the more picks they make, the more points they get through the attribute *strength*; the fewer the number of errors order-pickers make, the more points they

can earn through the attribute *accuracy*. These attributes and operating numbers also represent the basis of the needed work competencies for the position of order-pickers.

After creating an avatar, order-pickers get access to their own game profiles. Here they can find an overview of their characters' attributes, scores, leaderboards, summaries about their performance in the game (performance graphs) and a list of all badges. Badges can be earned during the game by reaching certain goals. For example, a badge is awarded for a series of ten orders without any error. Badges are rewarded with *attribute points*, and these can be used to upgrade the character's three attributes (speed, strength and accuracy). From the performance graphs in the profile, the order-pickers can see how many points they have already got in each of the three sections and develop their avatars in a certain direction.

From their profile, order-pickers can join a team (shift) to participate in the order-picking league. When joining a team for the first time, the game starts with an interactive tutorial. This takes place directly in a warehouse setting and is shown on the so-called in-game screens. These are big screens which are placed directly in the warehouse between the shelves. The tutorial consists of an interactive movie sequence in which the order-picker is introduced to the background story of the order-picking league and to the rules of the gamification application. During the tutorial, the order-pickers learn how to handle the handheld device and how to orient themselves within the warehouse. Furthermore they have to fulfil exemplary orders. The rules of the gamification application contain the order-picking process steps mentioned before. In summary, the order-pickers are trained in playing the game and develop the needed work competencies for their daily work routine at the same time.

Afterwards, the game round starts. The *in-game screens* show a character-specific animation whenever an order-pickers' character earns a badge. Additionally, the current position of the team on the leaderboard, the remaining game-round time and the earned team-points are displayed. Team points are the added-up points of each individual order-picker participating in the game round. Individual points are only visible on the players' profiles and on the personal handheld device. So, the players can decide whether they want to share this information with others.

At the point of delivery, a *feedback screen* gives the order-pickers information about the finished order. The recently earned points, badges and personal performance graphs for each point category are shown. Between orders order-pickers can choose to develop their profiles by investing attribute points into certain attributes.

When a game round is finished, a short *debriefing film* is shown on the in-game screens. The content of the film varies according to the team's performance and result. In addition, the best order-pickers are honoured.

Technically, the gamification environment consists of different systems. A back-end server communicates with the warehouse management system. From the mentioned information, it creates game events and administrates the order-pickers' profiles and game rounds. A specific add-on for the handheld devices adds game information to the conventional order list. The feedback and in-game screens are

client programs, which communicate with the backend. The user profiles runs as a web application, which can be reached with every browser that is connected to the backend server. All components and clients get connected via a WiFi network. The only interface that needs to be set is between the operating warehouse management system and the backend server; hence, easy implementation of this prototype onto any operating system is granted.

37.4.2 Experimental Study

The goal of the gamification environment is to support the development of work competencies of new untrained order-pickers and to foster motivation. This leads to the following research questions:

(1) *To what extent can gamification work-integrated training environments foster the development of work competencies*?
(2) *To what extent can gamification work-integrated training environments foster experiences of competence, autonomy regarding task meaningfulness*, *autonomy regarding decision freedom and relatedness?*

To investigate these questions, an experimental design was applied. Within an experimental hall, a storage depot setting, created for test and training purposes, was established. Study participants were assigned to groups, which represent shifts of order-pickers. These shifts were randomly assigned to the above-described gamified training and working condition (gamified group) or a traditional training and working condition with all game design elements switched off (control group). The training phase took 8 min in both groups. Participants in the gamified group were trained by using an interactive tutorial video with a fictional story framework. Participants from the control group were trained by a supervisor. The training was followed by a working phase, which took 20 min in both groups. The working phase in the gamified condition consisted of the above-described gamification prototype. The working phase in the control condition was a traditional working condition common for the context of order-picking. $N = 103$ participants took part in the study, 24 % female and 76 % male; $n = 52$ participants were assigned to the gamification group, $n = 51$ to the control group. The average age was 25 years ($M = 24.65$). 85 % of the participants were students. The participants did not have any prior experience in the context of order-picking.

Order-picking work competencies are operationalised by quantitative and qualitative performance indicators during the study. These variables were measured using behavioural data, which consisted of the number of picks as a measure for *quantitative performance* and the accuracy rate of the overall picks as measure for *qualitative performance*.

Experiences of *competence*, *autonomy regarding task meaningfulness*, *autonomy regarding decision freedom* and *relatedness* are assessed by a post-test questionnaire based on the intrinsic motivation inventory (Tsigilis and Theodosiou 2003).

All items were assessed on a seven-point Likert scale. The scales show good Cronbach's alpha values for the *autonomy regarding decision freedom* scale (3 items; $\alpha = .81$) and the *relatedness* scale (3 items; $\alpha = .86$) and an acceptable Cronbach's alpha value for the *competence* scale (4 items; $\alpha = .72$) and the *autonomy regarding task meaningfulness* scale (3 items; $\alpha = .76$; cf. Sailer 2016).

Results are calculated by applying a single factor, multivariate analysis of covariance (MANCOVA). As the size of the shifts varied across the sample, the shift size was included as a covariate. This statistical analysis shows the following results regarding the research questions:

1. *To what extent can gamification work-integrated training environments foster the development of work competencies*?

   - Regarding *quantitative performance*, the gamification group achieved 62.44 ($SD = 15.92$) picks on average, while the control group achieved 46.82 ($SD = 18.92$) picks. A MANCOVA indicates that this quantitative performance is significantly higher in the gamification group than in the control group, $F(1,100) = 72.49$, $p < .01$, $\eta_p^2 = .420$.
   - Regarding *qualitative performance*, the gamification group achieved an accuracy rate of 94 % ($SD = .07$) on average. The control group achieved an accuracy rate of 87 % ($SD = .14$) on average. A MANCOVA indicates that this qualitative performance is significantly higher in the gamification group than in the control group, $F(1,100) = 21.98$, $p < .01$, $\eta_p^2 = .180$.

2. *To what extent can gamification work-integrated training environments foster experiences of competence, autonomy regarding task meaningfulness, autonomy regarding decision freedom and relatedness?*

   - Regarding the *experience of competence*, the gamification group scored 4.81 ($SD = 1.40$) on a seven-point Likert scale, while the control group scored 4.11 ($SD = 1.13$). A MANCOVA indicates that participants from the gamification group have significantly higher experiences of competence than participants from the control group, $F(1,100) = 8.11$, $p < .01$, $\eta_p^2 = .075$.
   - Regarding the *experience of task meaningfulness (autonomy)*, the gamification group scored 5.46 (SD = 1.06) on a seven-point Likert scale, while the control group scored 4.34 ($SD = 1.38$). A MANCOVA indicates that participants from the gamification group have significantly higher experiences of task meaningfulness than participants from the control group, $F(1,100) = 18.90$, $p < .01$, $\eta_p^2 = .159$.
   - Regarding the *experience of decision freedom (autonomy)*, the gamification group scored 4.03 (SD = 1.49) on a seven-point Likert scale, while the control group scored 3.64 ($SD = 1.58$). A MANCOVA indicates that participants from the gamification group have significantly higher experiences of decision freedom than participants from the control group, $F(1,100) = 4.03$, $p < .05$, $\eta_p^2 = .039$.

- Regarding the *experience of relatedness*, the gamification group scored 3.31 ($SD = 1.47$) on a seven-point Likert scale, while the control group scored 1.93 ($SD = .99$). A MANCOVA indicates that participants from the gamification group have significantly higher experiences of relatedness than participants from the control group $F(1,100) = 27.85$, $p < .01$, $\eta_p^2 = .218$.

These results show that the gamification environment was superior in regard to performance and motivational indicators and succeeded in fostering the development of work competencies. Both *qualitative* and *quantitative performance* show evidence for the effective training of order-picking work competencies by using gamification compared to a traditional training by a supervisor. Regarding psychological need satisfaction, the gamification group reached higher levels of *competence*, *autonomy* (regarding *task meaningfulness* and *decision freedom*) and *relatedness* need satisfaction.

Gamification environments like the one described above seem to be a promising solution for developing work competencies and solving motivational problems, especially in barely stimulating working and learning contexts like intralogistics.

From a competence assessment perspective, the above-described study uses two types of performance measures to assess work competencies – number of picks and accuracy rate. Generally, competencies can be viewed and measured on a continuum including cognitive and affective-motivational traits that underlie perception, interpretation and decision-making that lead to performance in real-world situations (Blömeke et al. 2015). Looking at competence measurement from such an integrative perspective, the study covers the performance side of work competencies as well as the affective-motivational aspect. As gamification is theorised to have strong influences on motivation, this focus on motivation and performance is comprehensible. Nevertheless cognitive aspects of work competence development by gamification, which were not in focus of this empirical study, should be in focus of further research.

37.5 Conclusions

Gamification is quite a new approach in the field of game-based environments. Hence, most researchers investigate gamification from a media-science or business perspective, as it is from these areas that gamification originates. Theory-driven research from a psychological perspective is scarce (Hamari et al. 2014; Seaborn and Fels 2015). Based on the theoretical investigation from a psychological perspective, gamification seems to be a promising work-integrated approach for the development of work competencies. Gamification within working and training contexts takes advantage of the learning potential of the workplace itself while ensuring motivation by applying game design elements. By applying a psychological

perspective on competence development via gamification, mechanisms and effects of game design elements can be theoretically explained and led to the following assumptions: points, badges and leaderboards provide feedback and are thereby relevant for the development of work competencies as well as motivation by satisfying competence needs. Performance graphs provide more elaborated feedback and are particularly relevant for the optimisation of learning processes. A story framework can be efficient in ensuring motivation during the first stages of competence development and by addressing feelings of autonomy regarding task meaningfulness. Elaborated avatar systems with the opportunity for profile development can help to foster motivation by addressing psychological needs for autonomy regarding decision freedom and relatedness.

The lack of theory-driven empirical research on effects of gamification, which uses proper experiments or proper psychometric measurements (Hamari et al. 2014; Seaborn and Fels 2015), is addressed by the above-described study. This study is one step towards filling the empirical research gap regarding effects of gamification on competence development and motivation. The study showed that gamification is a feasible approach to be implemented within a training process directly on the job. Moreover results indicate that the development of order-picking work competencies can be fostered by applying a gamification environment within manual handling processes. Within barely stimulating and monotonous working contexts like intralogistics, gamification also helps to foster motivational outcomes including psychological need satisfaction. The theoretically described mechanisms of certain game elements are supported by the empirical results, although no differentiated and empirically validated statements about the impact of single game design elements can be made, which leads to further research.

Further research should concentrate on empirical and experimental studies from psychological perspectives to investigate cognitive aspects regarding competence development, which can possibly be affected by gamification. Besides that, further research should focus on the impact of single game design elements or single game design element groups. The study described in this chapter was executed within a storage depot setting in an experimental hall. Although the setting was designed to be as similar as possible to real working contexts in intralogistics, it still cannot be described as such. Effects of gamification on the development of work competencies in the real world have to be investigated in implementation studies. This would also help to get insights regarding long-term effects of gamification, which should be addressed by further research as well.

From the practitioners' perspective, the gamification case example provided evidence for the feasibility of gamification within manual handling processes. Within the case example, gamification was applied in existing intralogistics infrastructures and its underlying technical system. The case example showed that gamification can be implemented in existing technical infrastructures without changing the basic workflow itself.

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Chapter 38
Software Tools for Scaffolding Argumentation Competence Development

Omid Noroozi and Simon McAlister

38.1 Introduction

Argumentation competence helps professionals to convince people. Having the knowledge and the skill of argumentation along with a positive attitude to argue critically and reason is an important competence required in many and varied workplace and community contexts. This argumentation competence is particularly required in vocational, professional and higher education, for which students need to learn how to provide solid argumentation for their professional activities and decisions and to prepare for future professions. These students are expected to become qualified professionals with the ability to apply the rules of formal logic to explain their informed opinions and give reasons for how they carry out tasks and solve complex problems (Noroozi et al. 2012a, b, c).

Argumentation is often needed for students in vocational, professional and higher education to justify their reasons for performance. For example, students of environmental sciences need argumentation competence for analysing and evaluating various environmental awareness campaigns and controversial climate issues. In nursing, it is quite common for a nurse to pursue a patient's interests against doctors and even family interests. Students in the field of economics and management studies need to acquire argumentation competence to analyse and evaluate financial crises to respond to the rapidly changing global economy. In medicine, when medical doctors have to choose an adequate treatment, they have to justify that and argue why they take certain decisions. The same holds for a whole series of critical working situations. This need for argumentation competence requires students to be able

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to generate claims and back them up with evidence, acknowledge alternative perspectives and qualifiers, discuss various counter-arguments and opposing views and respond to those counter-arguments (see Kuhn 1991; Noroozi 2016; Toulmin 1958). Acquiring such a broad range of argumentation competence is surely in need of educational support, due to the complex, non-linear and ill-defined nature of argumentation (Noroozi et al. 2012a, b, c, 2013a, b, c). Technology-enhanced environments focusing on the role of software tools for scaffolding argumentation competence is one of the approaches developed with this in mind.

Many instructional scaffolds have been embedded in online environments through graphical representational tools in the form of schemes, tables or visualisations to support dialogical argumentation processes or in a more textual implementation in the form of cues and prompts or scripts to orchestrate various roles and activities of learners for procedural scaffolding of specific interaction patterns (see Kirschner et al. 2003; Scheuer et al. 2010; Noroozi et al. 2012a, b, c). In this chapter, four prominent software tools for scaffolding argumentation in online learning environments are described, including representational guidance tools, digital dialogue games and micro- and macro-scripting approaches. Furthermore, this chapter illustrates these software tools and explains how and when each of them could be used, and under which conditions, to optimally scaffold argumentation competence in vocational, professional and higher education.

38.2 Why Argumentation Matters?

Imagine yourself as an employee trying to convince your employer to give you a promotion or a salary increase. Imagine yourself as a defending lawyer in front of the jury in court. Imagine yourself as a child trying to convince your parents to buy you a bicycle when they find that vehicle dangerous. Or, finally, imagine yourself trying to convince your partner to spend your holidays on a beautiful beach in California rather than visiting your partner's family in Detroit. There are many varieties of these imaginings occurring in daily life, and argumentation and reasoning play a major role in all these situations.

These situations are simple examples of argumentation occurring in everybody's daily life while handling routine activities. It is probable that there is a greater and a more significant role for argumentation, critical thinking and reasoning in handling complex and societal issues. In the knowledge-based era, it is inevitable that professionals have to address rapidly changing global, environmental, societal and safety issues worldwide. There appear to be many controversial issues, such as climate change, biodiversity, food security, sustainability, microplastics, 'fracking', etc., which are complex and contested disputes and which lack consensus in both science and society about how to address them. Apart from appropriate specialisation of domain-specific knowledge, dealing with such complex and controversial issues will require qualified teams of professionals and experts from different disciplines who are able to actively express their ideas, participate in the knowledge

society, engage in constructive argumentation and analyse the various scenarios from different perspectives, in new learning and working contexts.

This reality has important implications for education, especially for providing students with a productive environment in which they acquire world-class argumentation competence. Students in vocational, professional and higher education need to acquire argumentation competence to be able to confront controversial and complex issues, rather than avoiding them, since they are to become future professional decision-makers for our society. That is why, over the last couple of decades, argumentation has been considered fundamental to class assignments, ranging from primary school to university. Argumentation is an integral part of many disciplines, from soft to hard sciences and from natural to social sciences. The presence and the use of argumentation and its alignments have been frequently observed across a diverse set of subjects such as history, linguistics, physics, medicine, philosophy, psychology, education, etc. (Noroozi et al. 2012a, b, c; Van Eemeren et al. 1987, 1996).

The value of having competence for generating valid, solid and well-grounded argumentation has been established for years in professional and secondary education (Bertelsen and Goodboy 2009; Page and Mukherjee 2007) as well as higher education (e.g. Noroozi and Mulder 2016; Noroozi et al. 2011, 2016a, b). As a general rule, students of all ages (regardless of what level of education they are at) are supposed to acquire argumentation competence, in order to be able to express their ideas in front of fellow members, expose their informed opinions and give reasons for the way in which they deal with their regular task assignments (see Noroozi et al. 2012a, b, c, 2016a, b). Over the last few decades, argumentation competence has even become more essential in educational settings, since many learning activities and class assignments in current classrooms are conducted in the form of teamwork with groups of learners (Hofstein and Lunetta 2004; Norris et al. 2008). To this end, for students to become qualified professionals who are capable of managing challenges which are caused by present societal issues and actively participating in the knowledge society, they are required to be able to construct arguments and support their positions, to consider and weigh arguments, to acknowledge counter-arguments, to refute counter-arguments with reasonable evidence, to clarify their uncertainties and misunderstanding and thus to achieve thoughtful understanding about the issue at stake (Aleixandre-Jimenez 2007).

38.3 What Is Argumentation?

Argumentation has various definitions in literature. The etymology of argumentation lies in the Latin *argumentum*, from *arguer* which means to make clear (see Kirschner et al. 2003). Argumentation (Osborne 2007) deals with justifying what a person or group should conclude and what should be done to reach a valid conclusion. A dictionary definition of argumentation is the act or process of forming reasons, making inductions, drawing conclusions and applying them to the topic of

discussion (Merriam-Webster's Online Dictionary). In scientific literature, argumentation has often been defined based on the purposes and the functions of argumentation. The purposes and the functions of argumentation mostly originated from Aristotle's theory who assumed that all knowledge, ideas and opinions that arise in rational thought are based on existing and current knowledge, opinions and insights (Van Eemeren et al. 1987, 1996). This assumption has led to the three different functions of argumentation, namely, didactic, rhetoric and dialectic. In didactic argumentation, knowledge is absolutely certain and reliable based on apodictic evidence. In rhetoric argumentation, the arguer sets up an argument to convince a real or imaginary audience of a claim or proposition using the audience's prejudices or sensibilities. In dialectic argumentation, proponents of alternative propositions test the acceptability of the standpoints at issue (Van Eemeren and Grootendorst 1992, 1999; Van Eemeren et al. 2008; Walton 2000). Dialectical forms of argumentation give just as much weight to counter-arguments as to the original argument. This is also needed in educational settings since 'knowing what is wrong matters as much as knowing what is right' (Osborne 2010, p. 463). Based on etymology of argumentation, in educational theory, students need to express their opinions on what they think, what they mean, what they believe and also what they need from learning partners to resolve differences of opinions on the issue at stake and solve complex problems that confront them. From this point of view, argumentation is not regarded only as a discourse for convincing learning partners and persuasion through logical and evidence-based belief but as a way to present and discuss disagreements and reasoning for demonstrating truth or falsehood and to gain in-depth understanding of the multiple perspectives of the issue at stake (see Kirschner et al. 2003).

38.4 What Is Argumentation Competence?

There is no homogeneous definition of argumentation competence among researchers, and as a consequence, there is no standardised instrument to analyse and assess argumentation competence. In a meta-analysis review by Rapanta et al. (2013), argumentation competence was categorised into metacognitive, meta-strategic and epistemological dimensions. Metacognitive dimension (know-what) refers to the structure, conceptual and epistemic quality of the argument. Meta-strategic dimension (know-how) refers to the presence or type of a specific argument element and the preference or avoidance of specific discourse strategies/genres. Epistemological dimension (know-be) refers to the quality and the goal of the argumentation (Rapanta et al. 2013; see also Kuhn 1991; Noroozi et al. 2012a, b, c; Toulmin 1958). In a more simplistic view, argumentation competence can be defined as the capability to effectively perform core tasks and activities in a certain profession (see Mulder 2014). Scientific evidence shows that many researchers tend to consider argumentation competence as the ability and the skills that individuals manifest during discourse (i.e. by means of the argument form, the use of strategies or as the achievement of an argumentation goal) (Rapanta et al. 2013). Kollar et al. (2007) argue that the

extent to which students perform their ability and skills during the discourse depends on their own (already developed) individual and often idiosyncratic internal script (argumentation knowledge) that indicates how a student will act in, and understand, a particular argumentation situation (see also Noroozi et al. 2013a, b, c). This is striking, since in many situations, students' actual knowledge on argumentation might not be reflected by their argumentation behaviour during discourse activities. In several studies by Stegmann et al. (2007, 2012), as well as Noroozi et al. (2013a, b, c), for example, although individual students demonstrated argumentation knowledge, they were not able either to put their knowledge in practice during discourse or in a similar argumentation task. Therefore, to have a reliable measurement of argumentation competence, one should not only rely on students' argumentation knowledge but also their behaviour during actual discourse (see also Andrew and McMullen 2000). Furthermore, students' psychological, emotional, motivational and social barriers may also affect their argumentative discourse activities, for instance, nervousness or anxiety while providing a claim or receiving a question (Gilbert 2004). There are cases where some individuals perceive peer feedback as critiques and personal attacks, rather than constructive feedback during argumentative discourse activities (Rourke and Kanuka 2007). Individuals may be emotionally attached to the topic of discussion, or it impinges on their belief system (e.g. issues like genetically modified food or veganism), and in such a case, reasoned argumentation becomes unfruitful, complicated or even impossible (Baumeister and Scher 1988; Leith and Baumeister 1996). Therefore, next to students' knowledge and skills, their attitude (the psychological, emotional, motivational and social barriers) towards argumentation should also be considered. We would therefore contend that argumentation competence is a set of knowledge, skills and attitudes (see Mulder 2014) that enable arguers to analyse a scenario, to support claims and back them up with evidence, to acknowledge alternative perspectives and qualifiers and to be able to respond to various counter-arguments (see Kuhn 1991; Noroozi et al. 2012a, b, c; Toulmin 1958).

38.5 The Need for Scaffolding Argumentation Competence

Historically, argumentation has been brought to bear, and shape, in the social conversation of daily life with friends in streets or in bars and coffee houses, but more recently, will online exchanges on social networking sites (SNS) provide any role for argumentation? Learners need, more than ever, to learn how to generate valid arguments, reason soundly and engage in argumentative discourse activities for solving complex problems (see Noroozi et al. 2012a, b, c). With the rapid growth of information and communication technology, and the swift growth and widespread accessibility of the Internet, schools are not the only privileged source of knowledge. Students have ubiquitous access to multiple resources for learning inside, and outside, the school setting at any time and place. Students are currently participating and learning in a broad range of contexts on SNS to translate and transform

knowledge across these spaces. Facebook, for example, has numerous merits (popularity, prevalence, simplicity, easy and free accessibility, etc.) and has the *potential* for a learning community to reflect, reason, share, improve understanding of topics and hence (co)construct knowledge for solving authentic and complex societal issues across various domains. Despite numerous instances of the use of SNS for learning purposes, they are commonly devoted to simple social interactions and resource and information sharing rather than the critical reasoning, deep processing and argumentation required for solving societal issues. As a result, interactions and discussions in SNS typically lack well-founded arguments and reasoned debate for promoting deep and elaborative learning. Indeed, the probability of locating instances of reasoned debate online might be equated to the success of 'panning for gold'. Adequate pedagogical design and instructional goals are needed if the use of SNS such as Facebook in the classroom is to improve learning performance in academic settings.

Unfortunately, the availability of instruction for teaching scientific argumentation and critical reasoning in typical curricula is limited; thus, this type of instruction tends to straddle a variety of courses, such as linguistics, philosophy, psychology and education (see Noroozi 2013). Even when instruction for argumentation and critical reasoning is available, a major challenge is teaching its complex, non-linear and ill-defined nature. Argumentation is subject to interpretation, and in some scenarios, the "facts" may be interpreted differently and are thus not necessarily immutable (see Scheuer et al. 2010, 2013). The ill-defined nature of argumentation makes it impossible for students to follow a set of strict rules and unbending laws on constructing arguments, responding to counter-arguments and engaging in transactive argumentation in order to gain and construct knowledge, drop false viewpoints, refine and modify claims and eliminate misunderstandings and misconceptions about the issue at stake (see Andriessen 2006). Furthermore, this is not an easy job for educators to teach argumentation competence with traditional instructional methods. The reason is that argumentation requires multiple competencies such as the ability to analyse a scenario, to support claims and back them up with evidence, to acknowledge alternative perspectives and to be able to respond to various counter-arguments (see Kuhn 1991; Toulmin 1958).

There could also be several other reasons for the need of scaffolding argumentation for students in vocational, professional and higher education. Students may hold different views on a topic which may be completely against, and incompatible with, the views of a learning partner (Jonassen and Kim 2010). Students may avoid producing counter-arguments against the arguments of the learning partner due to a fear of losing face or getting into a fight with them (Andriessen 2006). Students may also think that generating counter-arguments weakens their own arguments, and they focus on only supporting their own arguments rather than critically providing counter-arguments against other learning partners in the group (Nussbaum and Kardash 2005; Stein and Bernas 1999). To this end, telling students to argue with each other, for example, and simply letting them interact in the SNS are not an effective way to deal with complex issues, and hence it does not guarantee successful learning (Baker 1999; Van Amelsvoort et al. 2007). For these reasons, we

contend that argumentation should be scaffolded for students at all levels of education to be able to reason properly, engage in a reasoned debate and generate well-structured interactive argumentation that is beneficial for collaborative learning (see Kuhn 1991, 1992, 2005, 2009).

38.6 Scaffolding Argumentation Competence

The most promising recent approach to scaffolding argumentation is the use of technology-enhanced learning environments. During the beginning of the twenty-first century, various types of computer-supported systems have been introduced, tested and developed to help students build, structure, share and represent arguments with the aim of supporting learning and also to reduce some of the responsibilities of teachers (e.g. time and availability). In such computer-supported systems, tools are designed for the collaborative construction and development of arguments and also in some cases, for checking the consistency between the counterpartners, opponents, proponents and their proposed arguments (see Kirschner et al. 2003; Scheuer et al. 2010; Noroozi et al. 2012a, b, c). Below, four prominent computer-supported systems for scaffolding argumentation are described including argument representational tools, micro- and macro-scripting approaches as well as digital dialogue games.

38.6.1 Argument Representational Tools

Argument representational tools are among the most widely used means of scaffolding argumentation in online learning environments. Quoting from Suthers (2001, p. 3), 'representational tools are software interfaces in which users construct, examine, and manipulate external representations of their knowledge'. Such tools for scaffolding argumentation could be represented in various forms such as schematic representation (Schwarz and De Groot 2007), graphical visualisations (Noroozi et al. 2011) and/or tables (Suthers and Hundhausen 2003). For example, graphical representation of arguments helps students structure their claims and counterclaims (Noroozi et al. 2013a, b, c), clarify their arguments (Van Bruggen et al. 2002), keep their arguments on track (Veerman et al. 2002), broaden various aspects of the topic (Noroozi et al. 2013a, b, c), deepen specific aspects of the topic (Munneke et al. 2007; Van Amelsvoort et al. 2007, 2008) and discover new relationships and patterns of evidence (Suthers 2001) for the issue at stake. Furthermore, the expression of own opinions about an issue (for or against) has been found to be increased when arguments are being graphically represented in the interface (Lund et al. 2007).

Textual representational tools such as planning tools for writing (a shared outline facility for content linearisation) have also been shown to support argumentation construction (Erkens et al. 2005). Although both graphical and textual representational

tools have been reported to positively affect the quality of argumentative discourse activities (see Noroozi et al. 2012a, b, c), graphical and textual representational tools differ in terms of their learning outcomes. For example, in a study by Van Drie et al. (2005), although no significant difference was found between a graphical representation (argumentative diagram) and a linear representation (argument list) in terms of historical reasoning, diagram users engaged more in finding a balance in their argumentation, whereas matrix users engaged more in talking about historical changes. A study by Ertl et al. (2008) found that students benefit more from a graphical than a textually representation of the arguments. The same was true for the study of Janssen et al. (2010) which revealed that students with graphical representation produce higher-quality essays, better-supported arguments and higher quality of knowledge construction compared with the textual representation of arguments. No significant difference, however, was found between the two conditions in terms of quality of argumentative discourse activities. In a study by Marttunen and Laurinen (2007), both graphical and textual representation of arguments helped students elaborate their already constructed arguments as well as recalling and creating new claims and arguments.

An application of a graphical and textual representational tool for scaffolding argumentation can be seen within the context of a well-established computer-supported argumentation software named Learning to Argue: Generalized Support Across Domains (LASAD) (see Loll and Pinkwart 2013; Loll et al. 2012; Scheuer et al. 2012). LASAD is a highly configurable web-based platform for computer-based collaborative argumentation that supports argument mapping, argument visualisation and structural chat in various domains. The boxes in the diagram represent different types of statements such as 'claims' and 'evidence'. The graphical links represent different types of relations between statements such as 'support' and 'oppose' relations. The specific types of boxes and links can be configured in LASAD to support modelling different types of arguments in different domains, such as scientific and legal arguments. To this end, despite some differences, both textual and graphical representational tools can be designed to scaffold argumentation in online learning environments. Deciding on graphical, textual or combined use of such representational tools depends on the intended learning outcomes by the course designers and the teachers.

38.6.2 Micro-scripting Approach

Micro-scripting also known as computer-supported collaboration scripts provide students with step-by-step instruction, hints and guidelines on how to engage in argumentative discourse activities. Specifically, micro-scripting can be seen as a set of pedagogical models that determine the sequences of learning activities for individual members of a group during argumentative discourse activities (Kollar et al. 2006; Noroozi et al. 2012a, b, c; Weinberger and Fischer 2006). Such pedagogical models are beneficial for students because they are avoiding engaging in off-task

activities and also following a desired mode of interaction and argumentation. Such scripts have been mostly realised through prompts (Baker and Lund 1997) in the form of sentence starters (e.g. McAlister et al. 2004; Noroozi et al. 2013a, b, c) or question stems (e.g. Ge and Land 2004). Other types of scripts have also taken the form of predefined text boxes that can scaffold the construction of individual arguments and argumentation sequences (e.g. Stegmann et al. 2007, 2012; Noroozi et al. 2013a, b, c). For instance, prestructured boxes with corresponding labels (i.e. claim, datum and qualifier) have been used to help students generate their claims, back them up with evidence and acknowledge the limitation of the claims and alternative perspectives (e.g. Stegmann et al. 2007). Scripts can also be used to help students systematically respond to the arguments of the learning partners. For instance, a study by Stegmann et al. (2007) showed that multiple constraints categories of response sequences where messages are automatically labelled as argument, counter-argument or integration can help students adequately engage in argumentation sequences. Noroozi et al. (2013a, b, c) use a different approach for the design of the scripts. They designed a script that pointed students towards analysing the learning partners' arguments rather than emphasising construction of their own arguments.

The underlying rationale for such a design was that students become aware of the characteristics of argument elements when they paraphrase, evaluate and analyse their learning partners' arguments. As expected, the findings showed that scripts for analysing and evaluating learning partners' arguments and exchanging them in dialogic-sequential argumentation help students engage in high-quality argumentative discourse activities.

The scripting approach has also taken the form of a special tool that uses coercion to direct students towards a desired mode of argumentative discourse activities (see Beers et al. 2005, 2007). Specifically, they designed a process-specific support tool to facilitate the negotiation and grounding process. Surprisingly, when coercion was stronger, the achievement of common ground was more easily reached through negotiation (see also Kirschner et al. 2008).

To this end, micro-scripting has been realised through various forms in different studies. The common conclusion is that most scripts have been able to direct students towards the desired mode of interaction and argumentation during discourse activities.

38.6.3 Macro-scripting Approach

Macro-scripts refer to lesson plans that provide different roles, labour work and activities for students in learning groups during argumentative discourse activities. Examples of macro-scripting include traversion, rotation and fading. With traversion students are allowed to follow a series of the same learning activities, while only one element is tackled at any given time. With rotation students are stimulated to engage in each activity by changing the order of elements in a given set of

learning activities. With fading, students are allowed to work on a learning task with the support that can be gradually increased "faded in" or decreased "faded out" over time (Kobbe et al. 2007). For example, in a study by Dillenbourg and Jermann (2006), the Universanté script approach was used to guide students in following a series of activities such as (a) analysing the case; (b) summarising and explaining; (c) analysing, comparing and relating new information to prior knowledge; (d) giving feedback and critiquing and (e) problem-solving. Another macro-script known as ArgueGraph script (Dillenbourg and Jermann 2006) encouraged students to follow other types of argumentative discourse activities such as (a) generating arguments; (b) comparing, analysing and elaborating; (c) negotiating alternative arguments; (d) explaining and justifying ideas and (e) concluding and making connections. Weinberger et al. (2005) designed a peer-reviewed script that stimulated activities such as (a) constructing arguments in relation to theoretical concepts and (b) critiquing learning partners' arguments, distinguishing conflicting opinions on the issue and generating counter-arguments against the arguments of the learning partners. Findings of the ArgueGraph, Universanté and peer-reviewed scripts are positive in terms of directing students' argumentative discourse activities towards the intended learning outcomes. Rotating and assigning roles and division of the task are other examples of a macro-scripting approach. In such an approach, students are given predefined roles during argumentative learning activities, and in most cases, they are asked to rotate their roles in order to prevent them getting stuck in their original roles.

The underlying purpose for the use of macro-scripting approach is to provide learners with predefined roles and activities that can stimulate 'task coordination' during argumentative discourse activities. For example, in studies by De Wever et al. (2007) as well as Schellens et al. (2007), assigning roles (starter, moderator, summariser, theoretician and source researcher) helped students coordinate their activities for construction of knowledge. Another type of macro-script is known as 'conflict scheme' or 'personally seeded discussions'. In this approach students are formed in groups based on their conflicting perspectives on the issue at stake. In such an approach, students' original perspective on the issue is used as *seed comments* for the ensuing discussion (see Clark and Sampson 2007, 2008; Clark et al. 2009). In some cases, seed comments have been produced by experts to ensure optimal argumentative discourse activities. For example, a study by Clark et al. (2009) showed that students in an augmented-preset script condition (seed comments were provided by experts) outperformed students in a personally seeded script condition (students' own explanations were used as seed comments) in terms of quality of argumentation structure. Although both approaches were useful for the ensuing discussion, seed comments by experts provided a higher quality of argumentation structure compared with the condition in which seed comments were provided by students' own explanations. To this end, there is empirical evidence accumulating that macro-scripting approaches have positively facilitated argumentative discourse activities.

38.6.4 Digital Dialogue Games

In spite of the generally positive outcomes of computer-supported systems for scaffolding argumentation, such as the argument representational tools and micro- and macro-scripting approaches, most of these technology-enhanced learning environments have remained part of laboratory experiments and not made an explicit and integrated part of the curriculum within a particular discipline (see Driver et al. 2000; Noroozi 2013, 2016). There could be several reasons for this, which include: argumentation does not fit neatly into any traditional subject areas and is somewhat an 'orphan' topic; argumentation is an ill-defined domain, so principles for how best to instruct learners are likewise ill defined. Synthesis (the step in argumentation in which various lines of an argument are compared and combined) illustrates this. Synthesis is inherently a language-based and imprecise task, not lending itself easily to a traditional tutoring system approach that identifies problem areas and provides feedback and support (VanLehn 2006). There are some psychological, emotional and social barriers for teaching argumentation skills through instructional argument software in class settings including the incompatibility of learning partners' ideas on the issue at stake (Jonassen and Kim, 2010), lack of knowledge about the multiple opposing views (Leitão 2003), fear of losing face or getting into a fight with learning partners (Andriessen 2006) and of perceiving critiques and counterarguments as personal attacks (Rourke and Kanuka 2007). Furthermore, the lack of social context cues (e.g. physical form, accent, tone of voice, eye contact, nonverbal behaviour) in instructional argumentation software reduces the interest and willingness of learners to engage in collaborative argumentation with a high degree of motivation in these fantasy and virtual environments (see Noroozi et al. 2011, 2012a, b, c; Van Bruggen 2003). So computer-based support for facilitation of argumentation production and acquisition of argumentation competence can still be challenging for these reasons, especially in real educational settings in which motivational aspects for learning are crucial. Therefore, additional motivational factors in how to design educational technology are needed if students are to willingly, and with a high degree of motivation, acquire argumentation competence. Scientific evidence across various domains shows how educational games can be motivating and engaging to students for fun, creative thinking and learning. Educational games have rapidly become an important area of scientific research within technology-enhanced learning due to their positive impacts on students' motivation and learning. The motivational potential of educational games is undeniable, especially for teaching challenging intellectual subjects that are difficult to deal with in traditional educational situations.

Therefore, a promising approach to stimulate motivation for learning argumentation is to design and develop instructional argument games. Games provide students with a pleasurable environment that can stimulate motivation, while the support from the technology offers the possibility of students learning to argue soundly and correctly. A promising approach to include motivational aspects of learning for acquisition and application of argumentation is to design educational games with

technological innovations that provide learners with fun opportunities for learning. In such a combination of learning with fun, games provide learners with a pleasurable learning environment that can stimulate motivational aspects of learning, while the support from the technology offers the possibility of supporting argumentation (Noroozi and Mulder 2016). Learning argumentation through game and technology is based on a socio-constructivist perspective in which learners acquire essential aspects of argumentation by practising them, rather than reading and thinking, while engaging in an active dialogic process with learning partners' theory (Coffin and O'Halloran 2008). In such an approach, the game that is supported with technology motivates learners to actively construct their own learning conceptions and benefit from learning partners as a way to test, enlighten and clarify their uncertainties and refine their understandings. This active involvement of the learners in constructing their own conceptions of what they are learning, followed by reasoned debate, can be central to the learning processes and outcomes (see McAlister et al. 2004).

Research on argumentation has recently moved towards designing educational games with instructional argument software to help students engage in a desirable mode of interaction according to the rules of argumentation. Examples include digital dialogue games with an intelligent computer-based argumentation modelling system named 'Computer-Based Lab for Language Games in Education' (CoLLeGE) (e.g. Ravenscroft and Pilkington 2000), as well as computer-mediated argumentation tools such as AcademicTalk (e.g. McAlister et al. 2004) and InterLoc (e.g. Ravenscroft and McAlister 2006, 2008). Ravenscroft (2007, 2011) provides an overview of these digital dialogue games, which are designed to promote students' reasoning, conceptual change and argumentative dialogue processes and practices. This dialogic process followed by reasoned debate has been argued to be central to the process by which higher-order mental thinking, critical reasoning and reflection are developed (McAlister et al. 2004).

To this end, digital dialogue games are designed to motivate students and stimulate argumentative discourse activities and interactive discussions. Although the motivational potential of educational games is undeniable, especially for teaching challenging intellectual subjects that are difficult to deal with in traditional educational situations, designing games for the practice and acquisition of argumentation is still in its infancy, especially with respect to scientific results for real-world applications. Therefore, future research should focus on how to optimally design educational games for teaching the real-world competencies of argumentation, critical thinking and reasoning.

38.7 Design Approaches for Scaffolding Argumentation Competence

From a design-based perspective, there are two types of computer-supported systems for scaffolding argumentation, namely, discussion-oriented systems and argument modelling systems (see Bell 1997). In contrast to discussion-based systems which mostly focus on scaffolding argumentation by guiding learners on how to engage in desirable argumentative moves and sequences during discourse, the primary purpose of argument modelling systems is to scaffold argumentation by guiding learners on how to represent, structure, evaluate and analyse arguments.

38.7.1 Discussion-Oriented Systems

Discussion-oriented systems have been designed to stimulate a desired mode of interaction and foster argumentative discourse activities. From this perspective, students use discussion-oriented systems to interact and communicate with learning partners rather than examining, evaluating and practising their argumentation. These systems are based on a pedagogical approach that support students in conducting argumentative dialogues and help them use arguments in discussions to collaboratively explore various perspectives of the issue at stake (Scheuer et al. 2012). The application of discussion-based systems for scaffolding argumentation has been realised through digital dialogue games such as AcademicTalk (e.g. McAlister et al. 2004) and InterLoc (e.g. Ravenscroft and McAlister 2006) and micro-scripting approaches such as prompts (Baker and Lund 1997), sentence starters (Nussbaum et al. 2004) or question stems (Ge and Land 2004).

Both digital dialogue games and computer-supported collaboration scripts have been purposefully designed to help learners engage in reasoning dialogues, critical discussions and argumentative discourse based on a desired mode of communication and interaction. Specifically, these systems guide learners how to use arguments skilfully to communicate with one another during discussion and do not teach them how to acquire argumentation competence. On the one hand, micro-scripts have been mostly employed as dialogue models that suggest desirable argumentative moves and sequences (see Dillenbourg and Hong 2008). For example, a set of specific message labels known as conversational language has been designed to facilitate the construction of high levels of critical discourse (more argument, evidence, critique, explanation) during the interaction (Jeong 2006). On the other hand, digital dialogue games have been mostly employed as argumentative dialogue guidelines for students to ask critical questions, to respond critically to the replies of learning partners and to keep the discussions on topic (see McAlister et al. 2004).

InterLoc (Ravenscroft and McAlister 2006) and AcademicTalk (McAlister et al. 2004) as some of the most popular digital dialogue games, for example, have formalised argumentative discourse activities through a set of sentence openers with

particular roles and rules of interaction. Despite the positive effects of such sentence openers, for example, on shaping students interactions in a desirable interaction moves and sequences (Ravenscroft and McAlister 2006, 2008), fostering reasoning dialogues and critical discussions (McAlister et al. 2004), as well as reducing the typing workload of students (Baker and Lund 1997) during discourse activities, some limitations and critiques have also been proposed. For instance, it is hard to systematically organise such sentence openers in the user interface in such a way to promote students' critical thinking and reasoning (Baker and Lund 1997). Some of the sentence openers have been reported to be misused, for example, they do not correspond with the intentions in the actual message body (see Soller 2001). Some students might become frustrated if they do not have the choice to skip sentence openers, and as a result, they tend to pick unspecific sentence openers that do not match to the sentence body. Students might also become frustrated when they need to choose specific sentence openers among a large set of sentence openers and that also increases the search time as well (see Lazonder et al. 2003). To this end, regardless of both positive and negative effects of such scripts and digital dialogue games, the main focus of such approaches is not on improving students' argumentation competence. Discussion-oriented systems can be used only for stimulating argumentative discourse activities, interactive discussion and reasoning dialogues and not to help learners acquire argumentation competence as such.

38.7.2 Argument Modelling Systems

The scenario is slightly different with regard to scaffolding argumentation with modelling systems. Argument modelling systems have been designed to support students in training their reasoning competence and constructing, classifying, analysing, organising and evaluating new and existing arguments (see Scheuer et al. 2012, 2013). Building on Scheuer et al. (2012), two types of argument modelling systems can be classified. The first type of argument modelling systems has been designed to help students train their reasoning competence in inquiry/science learning such as Rashi (Woolf et al. 2005), Belvedere (Suthers et al. 2001) and Convince Me (Ranney and Schank 1998).

The second type of argument modelling systems has been designed to help students construct, analyse and evaluate legal arguments such as CATO (Aleven and Ashley 1997), LARGO (Pinkwart et al. 2006) and Carneades (Gordon et al. 2007). The application of argument modelling systems for scaffolding argumentation have been realised through representational guidance tools such as concept maps and diagrammatic argument representation as in Munneke et al. (2007).

Using argument modelling systems helps students learn about the criteria for representing, classifying and structuring the arguments and also analysing and evaluating the quality of arguments. Specifically, most argument modelling systems such as Reason!Able (Van Gelder 2002), Rashi (Woolf et al. 2005), Belvedere (Suthers 2003) and LARGO (Pinkwart et al. 2009) visualise arguments through

diagrammatic representations to support students in evaluating philosophical, legal and scientific arguments (see also Scheuer et al. 2013). Other applications of such argument modelling systems have been used to support inquiry-based learning (Suthers et al. 2001), collaborative writing of text (Munneke et al. 2007) and decision-making scenarios (Van Gelder 2002).

To this end, discussion-based systems mostly focus on scaffolding argumentation by guiding students on how to engage in desirable argumentative moves and sequences during discourse. Argument modelling systems have been designed to scaffold argumentation by guiding students on how to represent, structure, evaluate and analyse arguments. The choice of the course designers and planners in various levels of education depends on their targeted intended outcomes.

38.8 Conclusions

We have argued that there is a necessity for students at all levels to be able to perform argumentation, yet the opportunities to perform in-depth argumentation, both online through SNS or through face-to-face discussion, are receding. Furthermore, teaching argumentation is difficult because of its complex, non-linear and ill-defined nature, so educators are unsure of how to proceed. We know argumentation is required within discourse as a practical competence, with knowledge, skill and attitude involved. How then are we to offer students the educational opportunities to achieve argumentation competence? A good approach is to provide opportunities for student argumentation and to scaffold them with online tools. Four general approaches were discussed here.

Argument representational (modelling) tools allow users to build visualisations, and they are most useful for representing concise and cogent arguments, for instance, in science and more formal argumentation. Conversely, text and discussion-based tools are more useful with informal, less clearly defined and more nuanced argumentation.

Micro-scripting can be used with text-based or representational tools and guides the student at each stage of the interaction. Macro-scripting enables ‘fading’ of the scaffolding provided as the student gains experience. A practical point here is that the tool should not stand in the way of the student ‘performing’ the argumentation, and this is a criticism levelled at representational (modelling) systems, because the structuring task is sufficiently complex and distracts students from argumentation process. So while representational systems are less useful for performing real-time argumentation, they are ideal for reducing, refining and evaluating (existing) arguments. In this sense, discussion systems and representational systems are complementary, in that they provide different scaffolds to different stages of the construction of argumentation.

Digital dialogue games, with which the authors have extensive experience, add motivational aspects for learners and reduce the psychological/emotional barriers for some students engaging in peer argumentation. These text-based discussion

games are more personal, immersive and draw the participants into a discussion. With real-time (synchronous) discussion especially, the student performance of argumentation with peers is exciting and creates a personal involvement for the student by making their own proposals, needing to defend their own position and critiquing another's position. Of course this is argumentation 'in the making', so the results are not always good argumentation, but they are characteristic of what the student(s) can presently achieve in terms of real-world argumentation competence. Our expectation is that, given the opportunity and time to practise and improve their argumentation to become argumentationally competent, students in vocational, professional and higher education will be able to transfer those competence into almost any professional field or specialisation.

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Part IV
Competence Domains

Chapter 39
Modeling, Measurement, and Development of Professional Competence in Industrial-Technical Professions

Florina Ștefănică, Stephan Abele, Felix Walker, and Reinhold Nickolaus

39.1 Introduction

Present research work in the area of modeling, measurement and development of professional competence reflects different impulses:

1. The use of the concept of competence in the international context for defining aims of educational processes
2. The movement towards a stronger output orientation of educational systems
3. The agreements on the recognition of certificates and certifications of competencies needed in the international context and especially in the EU, as we find them in the European Qualification Framework and the National Qualification Frameworks
4. The efforts to implement a large-scale assessment of the area of vocational education
5. The implementation of management systems for competencies, which is increasingly gaining importance in companies
6. The dynamics of qualification requirements, which have sharpened the awareness of the fact that the individuals' potential can only be used efficiently in performance situations if their development is not exclusively oriented to fulfilling the current qualification requirements
7. The assumption that the employees' competencies represent the main competitive factor of developed economies.

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Furthermore, this research work is inspired by the initiation of numerous research programs (in Germany) which focus on the evidence-based modeling of professional competence and the development of reliable instruments for measuring them. In the last years, several programs in this field were carried out, e. g., the priority program of the German Research Foundation (DFG) "Competence Models for Assessing Individual Learning Outcomes and Evaluating Educational Processes" (see SPP Competence Models homepage) and the program "Technology-based assessment of Skills and Competencies in VET" funded by the German Federal Ministry of Education and Research (BMBF) (see ASCOT homepage). Furthermore, at the end of the first phase of a special program on the measurement of competencies in tertiary education (Modeling and Measuring Competencies in Higher Education – KoKoHs, see KoKoHs homepage), the program shall be continued until 2019.

This chapter provides an overview of the relevant research in industrial-technical fields, focusing on occupational fields at the nonacademic level. In our overview, we outline the findings on the structures of competencies and proficiency scaling which apply across fields, reflecting the relevant state of research within Germany. Then, we present new trends in the development of instruments for measuring professional competencies. Finally, we address the issue of the development of professional competence and relevant predictors for this development, illustrated by means of an example of one selected field.

39.2 Concept of Competence and Modeling of Professional Competencies

Three main approaches can be identified in the German debate on competencies: (1) performance-oriented concepts with behaviorist roots, (2) approaches which regard competencies as so-called generic skills, and (3) cognitive psychological approaches, which have found widespread application especially in the empirical educational research (see an overview in Klieme et al. 2007; also Winther 2010). Weinert (2001) regards competencies as acquirable dispositions which enable individuals to cope with situational demands of a specific field or of an action area using different individual resources (knowledge, abilities, skills, motivational, emotional, and volitional potentials, etc.).

We can find three types of approaches within the relevant work on the modeling of competencies in the industrial-technical fields in Germany: (1) holistic approaches trying to integrate professional, economic, social and creative aspects of professional competence (Rauner et al. 2009); (2) approaches preferred by companies, which try to make statements about levels of competencies by using self-assessment and external assessment (Erpenbeck and Rosenstiehl 2003; Heyse et al. 2004; Nickolaus and Seeber 2013); and (3) approaches which use pragmatic reasons for

concentrating on professional competence in the narrow sense and modeling professional competence using IRT-based methods (Nickolaus and Seeber 2013).

This chapter is limited to presenting relevant work regarding the third approach, because neither the first nor the second one are satisfactory in a research perspective – at least concerning the current state of research (Nickolaus and Seeber 2013; Klieme and Hartig 2007).

39.2.1 Structures of Professional Competence in Industrial-Technical Fields

At least two subcategories of professional competence can be empirically distinguished across fields: (1) professional knowledge and (2) the ability to apply this knowledge in changing situations, which are more or less problematic (Gschwendtner 2008, 2011; Geißel 2008; Nickolaus et al. 2008; Gschwendtner et al. 2009; Seeber 2008; Seeber and Nickolaus 2010). Furthermore, a third subcategory for manual skills is assumed for the industrial-technical domain (Nickolaus et al. 2011b). No recent work is available for this third subcategory – one plausible reason for neglecting the training and acquisition of manual skills in the last decades is the general assumption, almost certainly unjustified, that manual skills would become less important for the professional practice. For a broader view on professional competence, see Mulder (2014).

It is impressive, though also known from other domains (Kintsch 1998), that procedural knowledge, i.e., the field-specific methodological data, could not be empirically validated as a separate subcategory of professional knowledge (Geißel 2008; Nickolaus et al. 2008). This fact could possibly be attributed to the operationalization of procedural data, which, in the professional context, always includes declarative knowledge components. In all these cases, when empirically distinguishing between declarative and procedural knowledge did not succeed, paper-pencil tests were used for the assessment of knowledge. When assessing procedural knowledge by other means, e.g., when respondents had to perform or understand real actions, as, e.g., in the case of videos which document these actions, it succeeded to empirically separate declarative and procedural knowledge (Schmidt et al. 2014). This separation is observable towards the end of apprenticeship and mostly in the case of actions which have to be carried out rather often. Referring to Ackerman's theory of skill acquisition, this can be seen as an expression of routinization, at the mean time being connected with a proceduralization of declarative knowledge.

By way of example, Fig. 39.1 shows the results of the structure of professional competence for four industrial-technical fields, which were empirically confirmed several times (Abele 2014; Abele et al. 2012; Gschwendtner 2011; Nickolaus et al. 2011a, b; Schmidt et al. 2014; Gönnenwein et al. 2011). Moreover, similar analyses

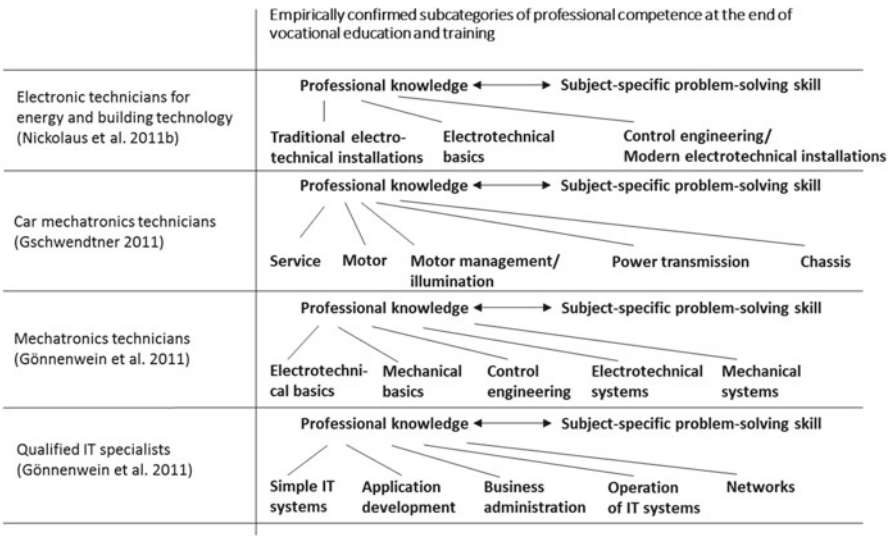

Fig. 39.1 Empirically confirmed subcategories of professional competence at the end of vocational education and training

on the subject-specific problem-solving skill show a two-dimensional structure, namely, a constructive and an analytic dimension (Walker et al. 2015).

This basic model was further elaborated drawing on the CLARION model (Sun 2006) within recent studies on subject-related competence modeling (Abele 2014; Schmidt et al. 2014).

CLARION is a cognitive architecture (see Fig. 39.2), which consists of four subsystems: (1) the action-centered system of knowledge, (2) the non-action-centered system of knowledge, (3) the motivational system, and (4) the metacognitive system. The action-centered system of knowledge refers to (motoric or cognitive) actions. The non-action-centered knowledge does not directly refer to actions, but it is possible to apply it to the action-centered knowledge and to performed actions: The non-action-centered knowledge becomes important for acting in the cases when the available action-centered knowledge does not suffice for coping with the requirements. The operations of both knowledge systems are influenced by the motivational and the metacognitive subsystems. The former determines, for example, the intensity of perception, cognition, and action, while the latter takes on a monitoring and guiding function within the architecture.

As indicated above, the present studies in the area of industrial-vocational training (Abele et al. 2012; Geißel 2008; Gschwendtner 2008; Lehmann and Seeber 2007; Nickolaus et al. 2010, 2011a, 2012a; Seeber and Lehmann 2011) show that at least two dimensions of professional competence are empirically distinguished across fields: (1) one dimension which depicts conceptual (professional) knowledge and (2) one dimension which represents the ability to update this knowledge by

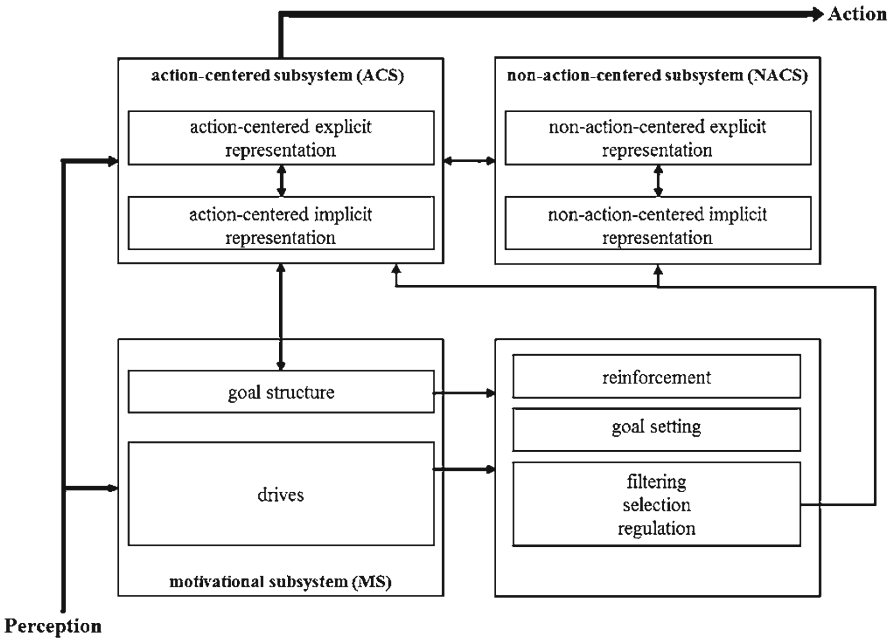

Fig. 39.2 CLARION model (After Sun 2007, p. 169)

dealing with problematic requirements, the so-called subject-specific problem-solving skill.

The tests for measuring the professional knowledge in the reported studies within the industrial-technical area primarily focus on the non-action-centered knowledge from the CLARION model. It should be pointed out here that the professional knowledge is not to be equated with the non-action-centered knowledge. Depending on the thematic focus, professional knowledge questions can ask for both non-action-centered and action-centered knowledge.

On the one hand, the subject-specific problem-solving skill is based on the action-centered knowledge. On the other hand, it is also supported by the interaction between the action-centered and the non-action-centered knowledge systems in cases when barriers arise. The subject-specific problem-solving skill was measured using simulations of technical systems where respondents had to detect errors which had been built into the simulated systems (Gschwendtner et al. 2009; Nickolaus et al. 2010, 2011a, 2012a; an overview in Seeber and Nickolaus 2010). This subject-specific problem-solving skill is estimated by the professional performances in line with the CLARION model.

The action-centered knowledge is located between the non-action-centered knowledge and the subject-specific problem-solving skills. This action-centered knowledge contains knowledge in an explicit form (if-then rules) on the one hand, and, on the other hand, implicit knowledge in the form of schemes which do

not require any conscious processing for updates (see also Abele 2014; Schmidt et al. 2014).

The structure of the action-centered knowledge can be described in accordance with Ackerman's theory of skill acquisition (Ackermann 1992) in three phases: the cognitive, the associative, and the autonomous phase. The cognitive phase is characterized by conscious coping processes in the sense of the application of if-then rules. In the associative phase, schemes are partially built; this process of the structure of schemes is further developed in the autonomous phase. As part of this skill acquisition, it seems possible that different parts of the professional knowledge relevant for action are integrated in the course of vocational education. On the one hand, this can lead to stronger associations and to the fusion of knowledge dimensions which have initially been separated. On the other hand, following Ackerman's theory of skill acquisition, we could further assume that the relevance of explicit non-action-centered knowledge shrinks for the service performances by means of routinization. Hence, the correlation between the explicit non-action-centered knowledge and the service performances shrinks as well. The necessary condition for this is that routinizations happen in the respective service performance segment (see also Abele 2014).

We may assume that the autonomous phase is not reached within the course of vocational education, especially in problematic situations. Hence, both the action-centered and the non-action-centered knowledge have to be updated for the service performances. Evidence for this matter is given by high latent correlations (approx. 0.8) between non-action-centered knowledge and subject-specific problem-solving skills, which have been documented for two professions in the industrial-technical area (car mechatronics technicians and electronic technicians) so far (Abele 2014; Gschwendtner et al. 2009; Nickolaus et al. 2011a). These correlations remain stable over the course of vocational education (Schmidt et al. 2014). The possibility that automated action-centered knowledge is also used for coping with complex and problematic requirements is not excluded.

Apart from this top-down approach to the development of action-centered knowledge, a bottom-up approach is possible as well, where the action-centered knowledge is described as a result of the action. Both variants may, in fact, be important.

The following question seems interesting in view of the claim of the CLARION model's validity: Which situation-specific points of reference are there between the different forms of knowledge and the performances demonstrated within requirement contexts? From Ackerman's (1992) theory of skill acquisition, we expect: (a) close associations between the non-action-centered knowledge and the performances in professional action contexts in the case of complex activities, which are probable for the building of routines only to a limited extent, and (b) lower associations in the case of reutilized and/or familiar activities (see also Abele 2014). This assumption is supported by the results of a meta-analysis by Schmidt and Hunter (1998): professional knowledge and professional performances correlated higher in complex requirement situations than in the case of less complex requirements. For car mechatronics technicians in the dual education system, Schmidt et al. (2014) show that routinizations of the action-centered knowledge occur in the case of

activities which are performed often (standard services). Correlations between the relevant non-action-centered knowledge and action plans and action evaluations are considerably lower in the end of vocational education and training than in the second year of training. In the second year, a one-dimensional model of competencies (action plans, action evaluations, non-action-centered knowledge which is relevant for each context) provides the best match to the data (Schmidt et al. 2014). This means that the structure of competencies within the action-centered knowledge changes in the course of vocational education, and we notice a differentiation process. This is also valid for the non-action-centered knowledge, which usually diversifies along content domains in the course of vocational education. Such differentiation processes of subject-specific non-action-centered knowledge are seen in other industrial-technical-fields as well (Gönnenwein et al. 2011; Geißel 2008; Gschwendtner 2008).

The relatively high correlations between the subject-specific problem-solving skill and the relevant non-action-centered knowledge, which remain stable in the course of vocational education (Schmidt et al. 2014), refer to the high relevance of the non-action-centered knowledge in complex situations. They suggest that the non-action-centered knowledge has to be updated in unfamiliar situations, when the action-centered knowledge has to be updated situation-specifically and partially regenerated. This consideration is supported by the meta-analysis by Dye et al. (1993), which shows that the correlations between professional performance and non-action-centered knowledge in complex situations are higher than in familiar situations.

It may be stated that: (1) the professional competence should be modeled multidimensionally, (2) changes in the structure of competencies can be observed in the course of the competence development, and (3) the correlations between the subcategories of non-action-centered knowledge and subject-specific problem-solving skill are very high and remain stable during the course of vocational education. Furthermore, it should be verified empirically whether, in the further competence development process, routines are built for complex situations as well (e.g., troubleshooting in technical systems).

39.2.2 Proficiency Scaling in Industrial-Technical Fields

Proficiency scaling for professional competence has been conducted in Germany for a range of industrial-technical professions: aircraft mechanic, industrial mechanic, plant mechanic, and carpenter (Lehmann and Seeber 2007). Proficiency scaling for both the professional knowledge and the subject-specific problem-solving skill has been carried out for car mechatronics technicians (Geißel 2008; Nickolaus et al. 2012a) and electronic technicians for energy and building technology (Geißel 2008; Nickolaus et al. 2012a). This chapter presents the example of proficiency scaling for the problem-solving skills of car mechatronics technicians.

39.2.2.1 Professional Knowledge

Significant proportions of the trainees do not meet the required standards stated in the curricula. This fact applies to both the professional knowledge and the subject-specific problem-solving skill across fields (Geißel 2008; Gschwendtner 2008; Lehmann and Seeber 2007; Nickolaus et al. 2012a). Item characteristics, which are documented more often as difficulty features across different fields, are presented in the following (see Nickolaus 2014):

1. Cognitive psychological features, e.g., those related to Bloom (1956) (Geißel 2008; Gschwendtner 2008; Nickolaus et al. 2009; Schumann and Eberle 2011; Seeber 2008).
2. Modeling requirements, i.e., the demand to generate independent cognitive modeling for the item requirements (ibid.).
3. Mathematical requirements are difficulty parameters to some extent (Seeber 2008), whereby the mathematical modeling seems to be especially challenging (see below).
4. The complexity of a requirement is documented as a difficulty parameter across fields (Gschwendtner 2008; similarly in physical contexts Kauertz 2009). Highly different indicators are used to define complexity, e.g., the number and linking of the elements to be taken into consideration, or global estimators, as well. "Complexity" is often associated with other difficulty parameters, e.g., the number of solution steps or the modeling requirements. Hence, statements about the location of the problems in the solution process are only possible to a limited extent (see also Nickolaus et al. 2012a).
5. Familiarity was partially documented as a difficulty feature (Gschwendtner 2008). Strictly speaking, familiarity does not represent a characteristic of an item, but a person's characteristic. The familiarity of requirements may correlate with the curricular foci and is an indicator for the skill needed in the solution process, in line with Ackerman's theory of skill acquisition (Ackermann 1992).
6. Different authors mention item formats as relevant for the degree of difficulty (Artelt et al. 2005; Sass 2010): e.g., the integration of images, which may facilitate or complicate the comprehension of the items. The correlation between the information in the text and the image seems important for the process of understanding. Whether items are open or closed partly seems to have an influence on item difficulty as well, possibly moderated by the test motivation of the respondents (Schumann and Eberle 2011). Open items are more difficult than closed ones for the same content, as the "complex appearance" of the item may influence the ability to solve it. The findings on external item characteristics are rather inconsistent (see also Klieme 2000; Draxler 2005).
7. In industrial-technical fields, data handbooks are available both in practical situations and in test or exam situations. They contain extensive information, which can be accessed by the users. The item-specific quality of reference to the handbooks, i.e., the manner it is possible to find relevant hints for the solving process (direct hints/indirect hints) in the handbooks, is listed as a difficulty feature by

some authors (Geißel 2008; Gschwendtner 2008; Lazar 2013). However, the observations of the handling of data handbooks indicate that the (necessary or possible) interaction between the respondents and the handbooks is not responsible for item difficulty, but rather the relevance of the topic within the data handbooks, i.e., the more or less important consideration of the topic in the handbook.

8. Field-specific characteristics seem to become important as well, as suggested in the case of qualified IT specialists (Lazar 2013). It remains unclear here whether the content-specific requirements are the reason for difficulty or the temporal placement of the contents and/or the time lag between the knowledge acquisition and the testing.
9. Gschwendtner (2012) also identifies the following difficulty characteristic, which appears both in educational and in work tasks when handling texts: the explicitness/implicitness of the relevant information in the text. If the information is not explicitly contained in the text, background knowledge and processing of the information are necessary. On a higher level of the reading process, modeling becomes relevant once more for creating references between the single information units. The findings indicate that, in professions where there are mostly cognitively weaker apprentices, the decoding poses difficulty and/or the missing conceptual knowledge becomes a barrier (Gschwendtner 2012).

39.2.2.2 Subject-Specific Problem-Solving Skill

The findings on item characteristics, which are determined for item difficulty in the area of subject-specific problem-solving skills, are presented in the following (see also Nickolaus 2014):

1. The complexity is determined by the number of information components which have to be linked in order to cope with the requirement.
2. The type of diagnosis (routine diagnosis, diagnosis guided by an expert system, self-diagnosis) and/or the requirements of the fault to be diagnosed, which requires the use of systematic bordering strategies to a greater or lesser degree, and thus their own modeling performance.
3. The dynamics of the system (static versus dynamic technical system), which simultaneously influences the degree of complexity.
4. The independent acquisition of relevant information, which may become necessary.
5. Metrological requirements.
6. Technological features (defective components versus contact problems, interruptions) (ibid.).

Many barriers become relevant at the same time, especially in the case of complex defects where the generation of appropriate hypotheses does not succeed from the start based on prior experience and a systematic development of strategies for the defect localization is necessary. This happens because, in addition to the

available information, further specific information has to be developed, hypotheses have to be generated and tested, and, in doing so, measurement procedures have to be chosen and applied competently, and adequate conclusions have to be drawn from the measurement results. This process is possibly made more difficult by the complexity and the dynamics of the technical plant and the type of defect.

A comparison of the difficulty features of items in the contexts of professional knowledge and troubleshooting in technical systems initially shows similarities regarding complexity and the modeling required. Furthermore, we assume that the processing of the information contained in the item description represents, in both cases, a hurdle which cannot be mastered without the relevant professional knowledge. Further information development, which is necessary in the case of complex troubleshooting for both the generation and the testing of hypotheses, also becomes relevant for the items on field-specific professional knowledge. Cognitive psychological-taxonomic features according to Bloom are not (directly) integrated into the explanatory models of item difficulty in the area of problem-solving; this could be explained by the fact that there are no items at the lower levels of this requirement feature. However, the high correlations (0.7–0.85) between the professional knowledge and the troubleshooting skill indicate that the degree of availability of the relevant professional knowledge at the levels of reproduction and understanding seems to be relevant for the barriers which occur in the process of defect diagnosis (Nickolaus et al. 2011a, 2012a).

Furthermore, the latest study on the subject-specific problem-solving skills of electronic technicians for automation technology documents that it is easier for apprentices to cope with constructive tasks (design and programming of control programs) than with analytic tasks (trouble shooting in technical systems) (Walker et al. 2016).

39.2.3 Example of Proficiency Scaling in the Area of Subject-Specific Problem-Solving Skill

Proficiency scaling for the troubleshooting competence of car mechatronics technicians is presented in the following as an example. At this point, it again becomes obvious that a significant proportion of the apprentices do not achieve the requirements defined within the curricula.

The following features are reasons for item difficulties:

The complexity of the item (correlation of the feature with item difficulty (0.89))
The type of measuring instrument which has to be used for fault diagnosis (0.25)
The type of information acquisition, distinguishing between independent/guided by the expert system (0.75)
The type of diagnosis, distinguishing between independent/guided by the expert system (0.81)
The independent modeling for the generation of hypotheses (0.76)
The type of fault: defect component/connection problems (0.57)

The analyses clearly reveal that item complexity is a result of the content-related requirements and other difficulty features. In order to increase the complexity of an item, we can replace a routine diagnosis by a rule-based diagnosis, or we can demand that more measurement values be needed. This fact is important mainly because the feature *complexity* cannot be used directly for the construction of items. However, the complexity of the ready-to-use items can be rated and so their difficulty can be estimated fairly accurately a priori. In the case of an accumulation of too easy or too difficult items, the construction of further items could be initiated.

Proficiency scaling for the problem-solving competence of car mechatronics technicians was conducted using the method proposed by Beaton and Allen (1992). Thus, three competence levels were determined. The lower bounds of these competence levels are −1 (level 1), 0.4 (level 2), and 1.8 (level 3) logits. Figure 39.3 shows that 212 apprentices reach level 1, 208 level 2, and 84 level 3. One hundred apprentices are below level 1. The content-related description of the levels, conducted using the critical items (level 1: item 5, 3, 2; level 2: item 9, 12.1, 13; level 3: item 11, 4, 12.2, 8), is presented in the following (Nickolaus et al. 2012a):

Level 1: Routinized and computer-aided solving of basic problems in the area of car mechatronics technicians

Persons at this level are able to collect the information in the work assignment and to use it for the diagnosis. Moreover, they have the ability to diagnose familiar defects (routine diagnosis) and to successfully perform a computer-aided diagnosis in the case of tasks which have a low level of complexity.

Level 2: Computer-aided and non-guided solving of medium-complex problems in the area of car mechatronics technicians

In addition to the skills on level 1, persons at this level have the ability to identify medium-complex defects by means of either computer-aided diagnosis or non-guided diagnosis. Moreover, they are able to use circuit diagrams and functions of the expert system not needed on level 1 (e.g., guided searching, calling up circuit diagrams) for the diagnostic work. Persons at level 2 are capable of independently developing easy diagnostic strategies and mentally modeling simple technical systems.

Level 3: Independent solving of complex problems in the area of car mechatronics technicians

In contrast to persons at levels 1 and 2, persons at this level have the ability to successfully handle highly complex tasks by means of non-guided diagnosis. Compared with persons at level 2, persons at level 3 know how to handle less frequently used measuring instruments (oscilloscope, measuring caliper). Furthermore, they have the ability to independently mentally model complex technical systems.

It remains to be said that for approx. 16.5 % of the trainees, it is even too demanding to perform diagnoses which are totally guided by the expert system. Some 35 % are able to diagnose only those defects which the expert system provides all the necessary hints for. Defects which require independent modeling, information acquisition, and strategy development are too demanding for these trainees in the end of apprenticeship (ibid.).

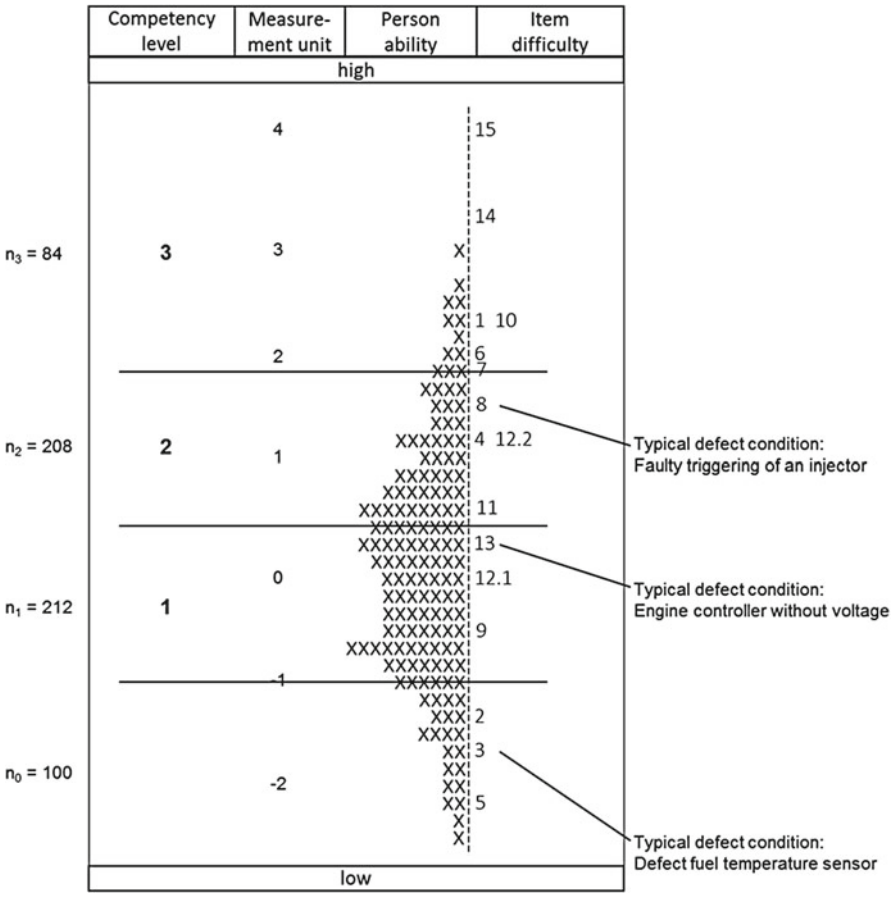

Fig. 39.3 Person abilities, item difficulties, respondents, and competence levels of problem-solving in the area of car mechatronics technicians (Nickolaus et al. 2012a)

39.3 Latest Developments in the Design of Instruments for the Measurement of Competencies in Industrial-Technical Fields

While data on the non-action-centered knowledge can be collected relatively well using paper-pencil tests, such acquisition turns out to be problematic for the action-centered knowledge and subject-specific problem-solving skills, as the situation-specific application of knowledge cannot be assessed reliably using such instruments. Work samples are an alternative possibility; however, large-scale studies of these may become very laborious and expensive. Against this background, the development of technical system simulations has begun in recent years. These simulations intend to reproduce real-life requirements as authentically as possible. Simulations were

developed, e.g., for the area of car mechatronics technicians, for electrotechnical systems, information systems, and control systems (see also Nickolaus et al. 2014; Nickolaus and Seeber 2013). In addition, videos aimed at ascertaining the action-centered knowledge were developed; they collect data on situation-specific action plans, situational judgment, and situation-specific knowledge. A detailed description can be found in Nickolaus et al. 2012a; Schmidt et al. 2014; Gschwendtner et al. 2009.

Validations for these forms of testing (simulations of technical systems) are partially available, including a criteria-related validation on the basis of performances in real situations: For instance, Gschwendtner et al. (2009) showed that the troubleshooting skills for car mechatronics technicians, collected in simulated and real situations, are validly convergent (latent correlations $r = 0.96$). Similar correlations have become apparent in a study on the troubleshooting competence of electronic technicians for automation technology (Walker 2014). This suggests that the attempt to authentically simulate these technical systems was successful. Consequently, these simulations seem attractive for educational purposes. Validations for the video-based assessment of the action-centered knowledge are still to come.

Such simulation-based forms of testing for other domains were developed as part of a special research program, funded by the Federal Ministry of Education and Research (BMBF) (see ASCOT homepage).

39.4 Development of Competence and Relevant Predictors

Research work on the development of professional competence in industrial-technical fields in Germany has mostly been limited to the analysis of relevant predictors up to now (Lehmann and Seeber 2007; Nickolaus et al. 2010, 2011a, 2012a; Nickolaus et al. 2012b; Seeber and Lehmann 2011). Intervention studies were only partially conducted (Petsch et al. 2014; Norwig et al. 2013). Empirical work on the development of competence levels in the course of professional biographies (via vocational education) is almost completely nonexistent.

The main predictors for the development of professional competence are usually the subject-specific prior knowledge, mathematical and reading basic competencies, the IQ, and, with substantially lower weights, the motivation and conditional factors for motivation, such as the experience of competence, attributions of relevance, and quality features of the teaching-learning arrangements (e.g., adaptivity, integration into the company's expert culture and excessive demand). An explanatory model for the professional competence of electronic technicians for automation technology, generated within a longitudinal study covering the complete course of vocational education, is presented exemplarily here (Fig. 39.4).

The subject-specific prior knowledge proves to be the main predictor for the development of professional competence. For the subject-specific problem-solving skill, the mathematical competence and, indirectly, the IQ become relevant as well. The direct path from the mathematical competence to the subject-specific

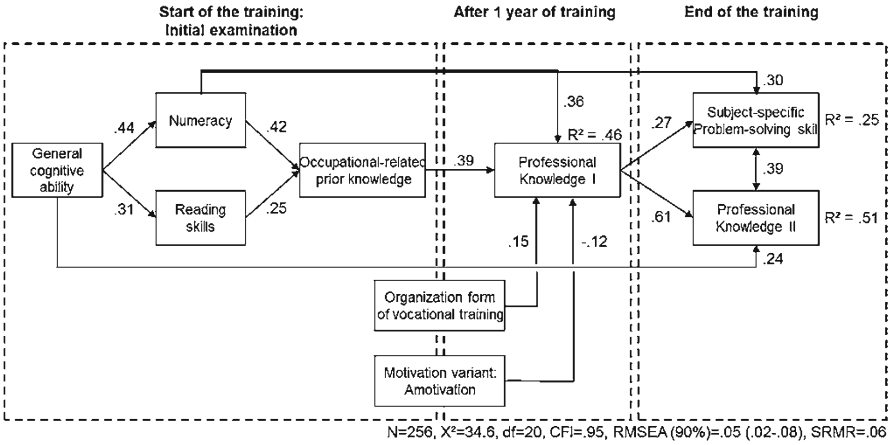

Fig. 39.4 Explanatory model for the professional competence of electronic technicians (Nickolaus et al. 2012a)

problem-solving skill was not confirmed in the case of the car mechatronics technicians (see Nickolaus et al. 2012a). Special analyses on the effect of the IQ and the dynamic problem-solving competence in the sense of Greif/Funke, as currently collected in the context of the PISA studies, explain the professional problem-solving competence only indirectly through the professional knowledge, both for electronic technicians and for car mechatronics technicians (Abele et al. 2012).

The impact of the type of vocational education (full time in school, dual education system) on the professional competence at the end of the first year of vocational education is interesting: the dual education system is advantageous (Geißel 2008; Nickolaus et al. 2008). A highly probable explanation for this finding is the unfavorable development of motivation of apprentices in the full-time school system; in this case, they are not always given subsequent contracts in companies, which are necessary for the continuation of the apprenticeship. Selection effects may play a role at the same time; these effects can be different depending on the apprenticeship market and hence depending on the temporal and regional placement of the survey.

When interpreting such explanatory models, we should be aware that the trait component of the motivation is probably contained in the performance data collected at the beginning of vocational education, and this component is probably underestimated at first sight. Quality features of teaching-learning arrangements, e.g., adaptivity, attributions of relevance, feedback, experience of competence, etc., influence the competence manifestations only indirectly through motivation (Nickolaus et al. 2008, 2010, 2011a; 2012a). The situations which were too demanding in the school context have only partially a direct impact. The relatively low predictive information of the quality features on the development of competence is often observable in field studies. An expansion of the set of instruments for measuring these quality features would probably not substantially increase the effect.

Research studies on qualitative descriptions of the development of professional competence exist sporadically (see Schmidt et al. 2014). These studies reveal, among other things, that the teaching in school within the dual education system is highly important for building competence. Furthermore, they show that skill acquisition is already relatively advanced in the course of vocational education and routinizations already take place in areas of activity which are carried out more frequently (ibid.).

39.5 Conclusions

The results of the modeling of competence show that the professional competence is multidimensional. The consequence is that multifaceted means of access are necessary for an examination practice which shows valid results.

The findings in the area of proficiency scaling include information on difficulty features; hence, they can be used in both a didactic and a diagnostic perspective. The knowledge about barriers provides criteria for which content fields and which solution steps the special support programs should focus on. At the same time, the documented levels clearly show that significant proportions of the trainees do not meet the required standards stated in the curricula and do not reach satisfactory competence standards measured against the requirements of the working world.

The latest developments in the design of instruments for competence measurement seem promising, as they prove to be highly valid and provide reliable results in a reasonable time. These instruments are partly used in examination practice already. In particular, the simulations show considerable potential for pedagogical purposes: the highly authentic simulations offer the possibility for individuals and bigger groups to perform realistic tasks on complex systems without the necessity of the expensive hardware. This seems highly important on the one hand, as there is insufficient opportunity for the trainees to acquire the desirable competencies in real tasks in many workshops. On the other hand, the potential of motivation of these simulations is strikingly positive, even in test situations.

The high predictive capacity of the apprentices' subject-specific prior knowledge on the development of skills is striking in regard to the explanatory models. This fact could offer the opportunity to focus attention on the trainee selection process. It should be pointed out here that special treatments were proved extremely performance enhancing in different intervention studies (see Norwig et al. 2013). Hence, the explanatory models do not represent irrefutable laws which totally escape pedagogic influence. The quality features, which become effective within these descriptions, represent compositions of process features and content-related fixations. The process features were usually captured as individual features in the study mentioned above. The curricular foci as well as the specific compositions of the quality features are still to be determined. While the high impact of the curricular foci on the competence development has been empirically shown (Gschwendtner 2011; Schmidt et al. 2014), studies on the relevance of these compositions have yet to

be carried out. Furthermore, it should be examined whether an optimization of the instruments for the measurement of the quality features would result in a higher explained variance of the performance data.

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Chapter 40
Competence Modeling and Measurement in Engineering Mechanics

Georg Spöttl and Frank Musekamp

40.1 Introduction

At universities, competence modeling and measuring is gaining more importance in order to improve the quality of university courses. Measurable indicators are being sought which can be used to achieve a better quality of lectures, laboratory courses, and seminars. Competence measurement is one of the options to achieve this goal. The competence model for engineering mechanics (EM) discussed in this chapter could be a contribution to this proposition.

In higher education, engineering mechanics – consisting of statics, mechanics of materials, and dynamics – is a basic subject for all engineering students and is a fundamental part of the established international professional knowledge of all engineering disciplines.

One of the reasons why a country like Germany, poor in natural resources, enjoys high economic prosperity is because it has a respectable number of highly qualified (mechanical) engineers, whose academic training is of particular significance. Although an acute lack of engineers has not yet been diagnosed, a lack of academically trained graduates can be expected in the medium-term future. This is mainly due to demographic changes as well as to the development in recent years which showed a relatively low number of graduates in engineering sciences (cf. Biersack et al. 2007). This expected future development is underlined by a disproportionately high amount of dropouts from engineering study courses, e.g., 36 % in the cohort of 2008/2009 (cf. Heublein et al. 2014, p. 4; Schmitz 2014, p. 5). One of the main causes seems to be performance problems and the accompanying motivational

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deficits of dropouts in the basic engineering courses. At the same time, a lack of subject-specific foundations also hampers the acquisition of interdisciplinarity competence as the latter must be above all learned and shown while dealing with subject-related contents. In addition, deep and specialized knowledge is indispensible for the professional work as an engineer, and the importance of such knowledge tends to be even greater during the first 5 years of work in such a profession.

Before any measures can be taken to improve the training of engineers, sound diagnostic information must be available which reveals whether there are weaknesses in teaching, and if so, where they can be located. Until now, it has been almost impossible to assess whether the high dropout rates are the result of a lack in general education prerequisites, of a lack of motivation or interest, of a misjudgment of the requirements for a course of study in the engineering sciences, or of poor teaching. Thus, there is a need for reliable instruments for measuring competence within the central subdisciplines of engineering sciences.

One such study program component of the engineering sciences is engineering mechanics (EM). It provides theoretical concepts for the application-oriented engineering disciplines (including mechanical engineering) and is a basic discipline for the approximately 400,000 students of engineering sciences in Germany. It is also an important part of internationally accepted standards of the professional knowledge of engineering (cf. Ferguson 2006, pp. 475–476) as the AHELO study demonstrates (cf. Musekamp and Pearce 2015).

Within the framework of the study presented here, two test instruments for the measurement of mechanical engineering competence will be developed and validated in order to help generate diagnostic information about the students' learning progress.

A competence model (which shall be referred to as the EM model in the remainder of this chapter) is the starting point and the most important basis for the assessment of general competence as well as for competencies specific to engineering mechanics. Its design is of primary importance for the explanatory power of test instruments based on it as well as for the generalization of the achieved results. Thus, this chapter aims at positioning the EM model within the current environment of empirical research on education and training, to provide a theoretical foundation for the specific design of the EM model and to be able to derive model-related hypotheses from it. Prior to this, the aims of the chapter will be sketched as well as the underlying theoretical framework of this competence concept.

40.2 Aims and Research Question

This chapter theoretically derives a competence model as the foundation for an assessment of learning results in engineering mechanics and places it within the current state of empirical educational research. Hypotheses on the competence structure and on the levels of mechanical engineering students will be derived from the model.

The main aim of the empirical work of the authors is to test a developed competence model by strictly distinguishing between the *external* requirements and the *internal* competencies of the students. The basic assumption is a fourfold model of competence, differentiating between abstracting real objects to mechanical models, formulating mathematical equations based on these models, solving these equations, and finally interpreting the outcomes of the calculations in terms of implications for real objects. The results provide evidence that this model is applicable for the – external – requirements. It will be demonstrated whether the EM model can be empirically proven and to what extent the EM competence of students can be differentiated and described based on the postulated dimensions of competence. If these questions can be answered in the affirmative, then the first instrument allows for accounting for different training pathways and can be used for comparative work at the institutional level (summative assessment). The second instrument then provides more profound information on the EM subdiscipline of static engineering in terms of the desired and actual states of the learning process at particular points in time which can be used for the configuration of teaching (formative assessment).

40.3 On the Concept of Competence

Competence is a "theory-relative" concept (as discussed in Erpenbeck and von Rosenstiel 2007, p. XII). This means that the term competence is defined in various ways and that the definition depends on the respective theoretical framework. Competence modeling thus needs to be located within the diversity of different perceptions of competence. Compared to the approaches in the earlier parts of this volume, our concept of competence is quite narrow in terms of the included content domains and cognitive processes. Since the assessment of narrow constructs usually yields better psychometric results, this is also for the sake of measurement efficiency. More importantly, however, is the theoretical fuzziness that appears, whenever competence is defined as an integrated set of very diverse personal attributes such as cognitive, motivational, or affective. It is also extremely difficult to measure these competence facets individually or holistically. This is why the competence model for EM described here will be reduced to cognitive performance positions. This means that this chapter will advocate a competence model with a focus on mental performance and knowledge. Thus, it differs from approaches aiming at a holistic model. Out of the four dimensions of competence advocated by Winterton (2009, p. 691) – cognitive competence, functional competence, social competence, and meta-competence – only the cognitive dimension will be applied. This is underlined by the fact that the development of a competence model to be validated is at the forefront. Established measuring procedures are applied. After a positive result of the validation of the model, it has to be considered whether the model should be amended in the face of a holistic understanding of competence. Additionally, the content domain of engineering mechanics at German higher education institutions is not yet far developed in terms of a theory of learning and instruction. Textbooks

are usually structured along the systematics of subject matter, while pedagogical and didactical aspects are neglected. Considering, in addition, the high degree of students' failure in EM courses, it becomes obvious that a closer look at the core of EM competence and its development is a necessary first step to go before more complex competence domains are included (e.g., application to real work problems or dealing with fuzzy task descriptions).

The starting point for theoretical considerations is the constitutive characteristic of the term *competence*, which means the ability to successfully use one's mental skills in certain situations (cf. Koeppen et al. 2008, p. 62). Situations, in turn, are characterized by environmental conditions, presenting themselves to the actor as objectively given conditions (often described as "context"). Straka and Macke (2009a) emphasize that context cannot (or not only) be interpreted as a natural condition but, in most cases, is determined by a socially assigned responsibility. Thus, competence is a dual construct according to which only people are considered competent who are able to accomplish *what they are supposed to accomplish* (cf. Spöttl and Musekamp 2009). This general outline of the concept of competence might be called "functional" or "pragmatic" (cf. Hartig et al. 2008) and is consistent with the concept of competence applied in the international large-scale assessments carried out by the OECD. This approach also guides the German empirical educational research, where competencies are defined as "context-specific cognitive dispositions that are acquired by learning and needed to successfully cope with certain situations or tasks in specific domains" (ibid., p. 9).

Against the background of these conditions and restrictions, the EM model explicitly differentiates between objective requirements (context) and the mental dispositions which are crucial to comply with these requirements (context-specific performance dispositions). The limitation to mental dispositions is due to the narrow competence term applied (see above). Skills, attitudes, or emotions that are of course important for performance will not be dealt with at the current stage of model development.

For the description of competence within the aspect of responsibility (context), a distinction is made between "subject matter" and "level of requirements." In order to describe the disposition part of the model, four processes of mechanical analysis will be referred to: (1) abstracting real objects to mechanical model, (2) converting mechanical models into mathematical equations, (3) solving equations, and (4) evaluating results (see Sect. 40.5). The context and disposition sides are related to each other insofar as the solution of every requirement defined on the context side requires a specific combination of the dispositions.

In order to describe the "disposition side," psychometric models of competence are generally applied which can be differentiated into structure and level models (cf. Leutner et al. 2008). Structure models describe qualitatively distinguishable mental characteristics (so-called constructs, dimensions, or scales) which can be differentiated on the basis of factor-analytical methods (e.g., specialist knowledge). Level models provide information about how the contents of high and low manifestations can be described within these dimensions. However, they do not necessarily provide predictions for the development of empirical competence.

40.4 Current State of Research

In order to define the normative requirements and to derive a hypothetical construct of cognitive dispositions required for the mastery of these norms, the state of the research in academic education research will be discussed, as well as scientific competence research in general and engineering programs. As for the context side of competence, the example of the EQF will be referred to as a relevant framework for qualifications. Empirical requirement analyses among working engineers (cf. Trevelyan and Tilli 2007) will not be considered since they generally are not sufficiently detailed to be used for basic subjects within EM. Political demands by engineering associations which primarily emphasize the greater importance of specialized competence compared to generic competence (cf. VDE 2005) will neither be discussed here for reasons of space. However, the opposite standpoint will also be discussed, i.e., to rely on general competencies as they can be applied in a more universal way.

40.4.1 Context: Behavioral Expectations and Responsibilities

Below competence will be equated to the sense of responsibility with socially formulated norms of behavior, because the allocation of responsibilities is always linked to the expectation of their fulfillment. Responsibilities are thus normative stipulations which arise from negotiations between social or political stakeholders. The result of such negotiations can be empirically described and used for the formulation of the requirement part of a competence model.

Although qualifications frameworks such as the European Qualifications Framework (EQF) (see Chap. 1 in this volume for more information about the EQF levels and other qualifications frameworks) primarily serve as an instrument for transnational comparability of graduation levels, they are also seen as "institutional requirements of superordinate importance," particularly in connection with competence orientation. This is easy to comprehend by taking a look at the structure of the European Qualifications Framework (EQF 2008).

The EQF encompasses eight levels, three of which are academic courses of study (6 = bachelor level, 7 = master level, 8 = doctorate level). These levels are described with the help of mental characteristics. In addition to *knowledge* and *skills*, they also contain *competence* as the proven ability to make use of knowledge, skills, and personal, social, and/or methodological abilities during work or study situations and within one's professional and personal development (The European Qualifications Framework of Lifelong Learning (EQF) 2008, p.11). The categories for the qualifications framework can be more closely defined with the help of descriptors which formulate personal learning outcomes. The assignment to levels of the category *competence* will be accomplished through situational conditions and contextual characteristics, as underlined in the following formulations:

> Management of complex technical or professional activities or projects, taking over responsibility for decision-making in *unpredictable work or study contexts* (Level 6).
>
> Management and shaping of complex, unpredictable work or study contexts *which require new strategic approaches* (Level 7, EQF 2008, p. 13; italics are of the authors).

The use of context characteristics in the descriptors shows that requirements will be different according to each context, although the increase is not always coherently formulated. For the individual, this means that a certain *behavior* will be *expected* for the particular context of the level in question.

Against this background, *socially agreed-upon behavioral expectations and/or context characteristics* should be formulated as prerequisites for the required performances. At the same time, the performance levels (requirement level) must be determined in a more detailed and stringent way as this is, e.g., the case in qualifications frameworks.

40.4.2 Mental Disposition: Knowledge and Cognitive Processes

In order to achieve an empirically visible and profitable structure for the disposition side of the EM model, the current state of research will be examined with regard to which psychological or subject-oriented aspects are empirically meaningful for the structural organization and level descriptions of EM competencies.

Psychometrically validated competence models for engineers in general or for EM in particular do not yet exist, neither on a national nor on an international level (cf. Zlatkin-Troitschanskaia and Kuhn 2010). There has been a recent attempt to model and psychometrically test engineering competence. In the civil engineering strand of the OECD Program *Assessment of Higher Education Learning Outcomes* (AHELO, Tremblay, Lalancette, and Roseveare 2012), a framework has been developed that – similar to KOM-ING – differentiates between an objective part called *item situation* and a mental part labeled *competence*. The latter contains the construct *engineering processes* and *basic/engineering sciences* in addition to *generic skills*. Empirical validation was carried out through computer-based tests and probability-based test models (cf. OECD 2012). Since EM competence only plays minor role within the AHELO model and there are no further academic competence models for engineering, general educational models of natural sciences will be analyzed.

Almost all recently developed competence models for physics and mathematics claiming to be psychometrically testable cover at least the two dimensions: *cognitive activities*, analogous to *cognitive processes* discussed by Anderson and Krathwohl (2001), and *content areas*. Thus, Senkbeil et al. (2005) differentiate, e.g., between *cognitive processes* (p. 168) and *basic concepts/content areas* (p. 171). However, not all approaches are explicitly differentiated into dealing with content areas such as themes allocated to the *structure of discipline* or their internal cognitive representation in the sense of *knowledge* (see, e.g., Anderson and Krathwohl 2001)

or a congruent structure of both aspects. It should be taken into account that *cognitive processes* do not deal with individual thought processes connected to particular situations as the term suggests but with a long-term disposition toward generating such processes.

The *content dimension* of the currently discussed competence models varies along with the differences of the examined domains. However, generally, models whose subject-area structure is connected to particular disciplines can be differentiated from those which have interdisciplinary concepts as a content dimension. Prototypically, the modeling within the framework of the PISA studies is led by *big ideas* (OECD 1999. p. 12). This means interrelated and strongly networked concepts in domains like mathematics which can be dealt with under a common and superordinate aspect. In contrast, the German national supplementary tests of PISA 2000 differentiated, e.g., between the subject-systematical areas of learning of arithmetic, algebra, geometry, and stochastics in order to improve the informational content of the results from a national perspective.

The acceptance of a hierarchical structure of cognitive processes is increasingly being abandoned in favor of categorical structures. Instead, levels are supposed and in part empirically proven based on content areas or content concepts (and their application). Neumann et al. (2013) consider, e.g., competence development in physics as the expansion and differentiation of knowledge, accompanied by an increasing conceptual understanding. They test the hypothesis that the pupils' concept of energy is developing hierarchically in ascending order along the four *content*-specific levels of (1) forms and sources of energy, (2) changes and transfer of energy, (3) degradation of energy, and (4) conservation of energy. Conforming to expectations, it turns out that there is a significant statistical connection between the empirical difficulty of a task and the stage of development.

In recent years, instruments for compiling skills are also being developed in the international academic world with a focus on engineering mechanics. Thus, so-called concept inventories (cf. Richardson et al. 2003; Steif and Dantzler 2005) are being developed which raise the claim of being able to pinpoint conceptual understanding as well as misunderstanding. The *concept inventories* are partially psychometrically validated (cf. Steif 2004; Steif and Dantzler 2005) and anticipate the direct use for the development of teaching curricula. There is hope that inappropriate conceptual knowledge can be diagnosed and – based on this diagnosis – changed through teaching (cf. Steif and Hansen 2006; Steif and Dollár 2005). However, the question as to whether this expectation can really be fulfilled is not undisputed, as shown in an independent test of the *force concept inventory* (FCI, cf. Hestenes et al. 1992). The validity of this instrument, which originally was said to be able to differentiate between test subjects who had a Newtonian conception of force from test subjects with various lesser-informed conceptions of force, is relativized by Huffman and Heller (1995) as well as Schecker and Gerdes (1999). Based on different data, they conclude that the FCI cannot reliably differentiate between the six dimensions (kinematics, principle of inertia, force and momentum, interaction of forces, overlapping of forces, special forces) and therefore cannot diagnose the pupils' possible conceptions of the concept of force.

In view of the present state of research, the following four theses for the justification of the disposition side of an EM model are emerging: (1) context-specific performance dispositions are only conceivable as a combination of cognitive processes and knowledge contents. In order to make a (2) detailed diagnosis of students' skills, it makes sense to assess central cognitive processes as separate dimensions, while keeping in mind that the solving of real EM tasks often involves several processes at the same time. The highly disciplined structure of EM and the academic teaching involved implies (3) a subject-specific structure of knowledge contents, e.g., according to statics, dynamics, and so on. A categorical structuring of (4) cognitive processes is preferred to a hierarchical order, although the development of competence along the content areas that are based on each other should not be excluded.

40.5 Competence Model for Mechanical Engineering

Against the backdrop of this current state of research, the ME Model is constructed in the following way. In order to do justice to the dual structure of competence, the ME Model encompasses two matrices. The matrix on the left defines the objective requirements of competence in the sense of supra-individually valid expectations of behavior (context). The matrix on the right represents the internal mental requirements which are necessary for coping with the context side (context-specific performance dispositions) (cf. Fig. 40.1). While the context side of the EM model represents the setting of norms, the disposition side can be seen as a hypothetical construct which requires empirical testing. The idea of the model was first explained in Straka and Macke (2009a)

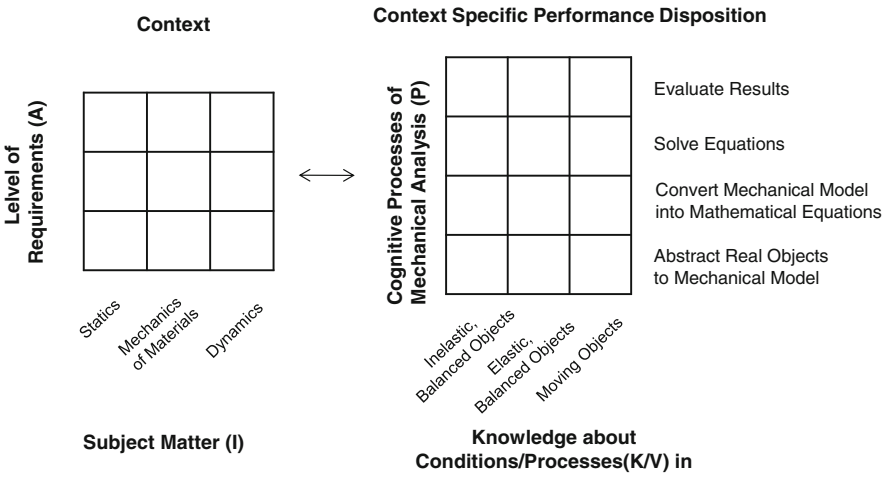

Fig. 40.1 Competence model for engineering mechanics for students of mechanical engineering (EM model)

The context and disposition sides are related to each other insofar as the solution of every requirement that is defined on the context side requires a specific combination of the dispositions. Work on a real task of statics with a given level of difficulty requires action of the four cognitive processes with the available knowledge on rigid bodies in equilibrium.

40.5.1 Context

The requirements in the field of EM can in general result from the perspective of the subject to be learned, from the perspective of the corresponding academic disciplines – such as design methods – or from the world of work. The context side of the model concentrates on the question of what is expected from *students* of mechanical engineering, i.e., under which conditions they are supposed to achieve EM-related performance.

In basic mechanical engineering courses, students are expected to intellectually comprehend and apply the specialized theories and concepts of EM as well as the methods of thinking and working specific to the subject. The application of the subject-specific basics which they are supposed to learn is, however, *not* part of the expectations (although these basics are of course applied in professional tasks). Usually, the tasks are accomplished with simple tools such as paper, pencil, and pocket calculator, whereas the use of tools relevant for the world of work (such as computers) is not expected.

Against this background, context is concretized by choosing problems out of the canon of (1) subject contents, and (2) the level of requirements is chosen by adjusting the so-called framework conditions of mechanical objects.

Ad 1: There is a documented content structure for EM, visible in textbooks. Most of the multivolume textbooks deal with statics, mechanics of materials, and dynamics in this order. Further areas such as fluid mechanics will not be taken into consideration in this chapter since they are dealt with on various scales in different higher education institutions.

Ad 2: Requirements vary with the complexity of the mechanical objects to be dealt with, and the level of requirements can be concretized by changing the number and type of the so-called boundary conditions which describe the displacement and strength conditions of the boundaries of objects in mechanical systems (cf. Gross et al. 2011, p. 128). The number and type of boundary conditions can be objectively set for EM tasks and can be confined to an area where the solving of tasks is possible with the aid of paper, pencil, and calculator.

Summing up, it is expected of students of engineering sciences in the subdiscipline of EM that they solve tasks which are to a large extent clearly assigned to one of the three subject areas of statics, mechanics of materials, or dynamics and in which only a few or simplified boundary conditions are to be considered so that they can be worked on with the help of paper, pencil, and calculator. Both dimensions for the description of competence within the aspect of responsibility (context) are thus

subject contents and *level of requirements*. The mental dispositions for achievement described below are related to this context.

40.5.2 Context-Specific Disposition of Performance

The underlying cognitive processes for the solving of EM tasks are very similar to the mathematical modeling described by Blum (1993). In EM, real existing circumstances must as well be transferred into models, and their validity must be tested: (prospective) engineers have to analyze problems in EM, understand the fundamentals, and transfer a real object into a physical model. The resulting mathematical problems must be solved, and the interpretation of the results, which connects back to the real object, closes the circle (cf. Hibbeler 2010, p. 12). Since diagnostic information should not only serve to compare performance at an institutional level, but also for the improvement of teaching (formative assessment), a separate recording of these processes in the sense of their individual dimensions makes sense.

EM-specific content areas on the disposition side of the model can only be interpreted in the sense of individually retrievable knowledge. In general, knowledge is defined as "permanent availability of understood information" (cf. Straka and Macke 2009b, p. 20) and can be further differentiated into knowledge about contents and concepts as well as knowledge about methods. In EM, knowledge of concepts (K) and knowledge of methods (V) are predominantly very specifically connected (K/V). However, they can be conceptually subsumed under the externally given content structure of EM, *statics*, *mechanics of materials*, and *dynamics*. For example, knowledge about the concept of support reaction and the methods for its definition belongs to statics. Similarly, *defining the bending line* is an example for mechanics of materials, and *defining the equation of motion* is an example for dynamics. In order to conceptually differentiate between statics, mechanics of materials, and dynamics at an external level or an internal level, knowledge of concepts and methods of EM (K/V) have to be assigned to *rigid bodies in equilibrium*, *elastic bodies in equilibrium*, and *moving bodies*. The performance dispositions result from the processes of mechanical modeling (P) which are applied in EM with regard to the individual knowledge about concepts and methods of EM (K/V) (see Fig. 40.1).

40.5.3 Context-Specific Implications for Learning

It must be kept in mind that the four cognitive processes of mechanical analysis are handled with differing intensity in typical EM courses and textbooks. For example, in mechanical engineering, the first step of abstraction is usually omitted, and one starts directly with mechanical models. In other scientific study courses of the engineering sciences, additional differences in terms of weighting subject contents

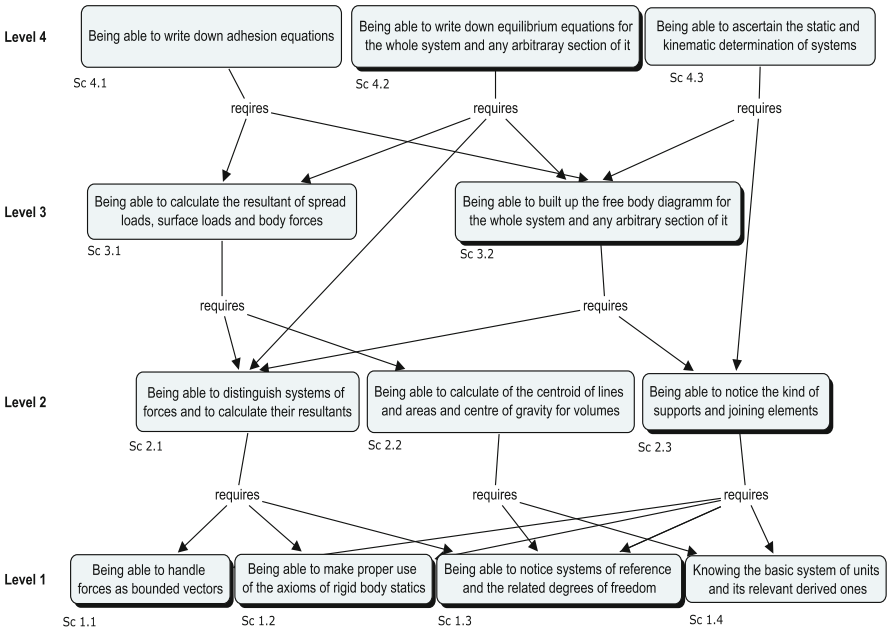

Fig. 40.2 Learning set of the ability to convert mechanical models into mathematical equations

may occur. However, it can be assumed that teaching (and hopefully also learning) the entire process of mechanical analysis could facilitate the transfer of EM competence into more specialized, advanced courses as well as to the world of work.

For this purpose, the EM model has been further differentiated by describing each of the 12 subcapabilities by a hierarchical structure of prerequisite capabilities (learning sets, see Fig. 40.2). It is assumed that the solving of particular groups of tasks is based on mastering basic tasks and that the "not yet competent" status in a particular capability can be changed by successive training of that very capability or its prerequisites. Furthermore, it is expected that the learning sets allow the identification of "not yet mastered" subject contents and guide lecturers and students with feedback.

A total of 120 open-ended items (CRTs) have been developed for the four statics dimensions of the model (30 items for each cell) with the aim of providing information about the students' strengths and weaknesses in the processes of abstracting, converting, calculation, and evaluation. In addition to these profiles, each item can be described according to its corresponding learning set in order to identify the particular requirements within each of the subdimensions of the construct. This may give advice to both students and lecturers about what should be learned next. Figure 40.3 shows an example item for the subdimension "convert static models into mathematical equations," which is situated at the fourth level of the learning set and requires six prerequisite capabilities on all subsequent levels (see highlighted boxes in Fig. 40.2). If a student's test result indicates that she/he is not yet able to deal with

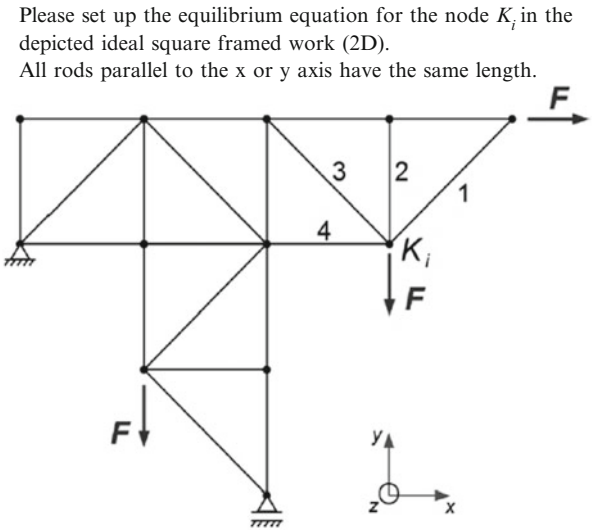

Fig. 40.3 Example item for the sub-construct of "convert static models into mathematical equations"

tasks of this type, the subcapabilities Sc3.2 and Sc2.3 as well as the basic capabilities of the first level (see Fig. 40.3) can be addressed by special teaching interventions or additional learning efforts by the student.

For the sake of detailed access to the students' (sub)capabilities, the test measures student ability to manage the process of mechanical analysis separately (including abstraction, conversion, solving, and evaluation) but not the connection of those single competencies as a challenge in its own right. However, mastery of the complete process is crucial for engineers and is usually required for EM exams. Presumably, this reduces the risk of score inflation (cf. Koretz 2008) because it avoids a complete alignment between assessment and examination requirements without losing relevance for grading. This highlights the pedagogical benefit of KOM-ING and deliberately delimits it from examination and benchmarking purposes.

40.6 Learning and Teaching-Theoretical Classification and Hypotheses

The choice of psychologically characterized terms used so far should not disguise the fact that the EM model is a modern description of teaching aims, such as formulated in empirical research on education and training. In this research field, a teaching aim is "seen as a personal attribute which in turn is defined through a number of tasks" (Klauer 1974, p. 63, translated by the authors). In this very sense, the disposition part of the EM model specifies what should be done with which content

(content x process). The resulting groups of tasks are labeled with terms representing personal attributes as a subject of learning (e.g., knowledge). The disposition part of the model is thus to be understood as an academic teaching goal within the subject of EM. The personal attributes result from a blending of process and content dimensions and can be interpreted as EM-specific skills. For instance, the left lower cell of the disposition side of the EM model is to be seen as the (partial) "ability to abstract real bodies in equilibrium into a mechanical model" (see Fig. 40.1).

The advantages of the EM model lie in the precise formulation of the theoretical construct of competence which allows for strict testing. This is among others carried out by the ex ante formulation of task characteristics, where it is assumed that they will either make the solution of (test) tasks easier or more difficult. If it is possible to predict which groups of tasks will be more difficult than others, then one can get a valid idea of competence (cf., e.g., Embretson 1983). In addition to the usual generally accepted complexity-determining characteristics of (test) tasks, such as the amount of steps needed to solve a task, the EM model also permits to derive the following EM-specific hypotheses.

It is assumed that groups of tasks build upon one another, i.e., that the solving of particular groups of tasks is based on the mastery of more basic tasks (cf. Gagné and Paradise 1961). This hierarchical structure of teaching content is also characteristic for EM and will be explained within the framework of this study.

First hypothesis: The location of a (test) task within the overall hierarchy of EM learning contents has a significant influence on its difficulty – tasks placed higher in the hierarchy are more difficult than tasks of the lower hierarchy levels. A hierarchical structure of content cannot only be identified in statics, mechanics of materials, and dynamics. Moreover, there is at least a partial cumulative interrelationship between these three areas. For this reason, competence development within EM is expected to occur along the content dimension, as, for example, Neumann et al. (2013) have demonstrated within the content area of *energy*. In the subject of the mechanics of materials, the contents of statics are extended by material laws and kinematics.

That implies the second hypothesis: On average, tasks of statics are easier to solve than tasks of mechanics of materials. In dynamics, this relationship is even more differentiated. While the subarea of kinematics (description of motion without taking into account the causal forces) is largely independent of the contents of statics, previous knowledge of statics is indispensible in kinetics (motion as the result of forces). Against this background, the second hypothesis should also be to a lesser degree valid for statics and dynamics. Since dynamics (apart from oscillations) as a rule only deal with rigid bodies, mechanics of materials and dynamics should – if at all – only have a very weak cumulative relationship.

Real mechanical objects show different levels of complexity which is reflected in the term "level of requirements." It is assumed that the difficulty of (test) tasks also varies along with the complexity of the objects, resulting in the third hypothesis: the greater in number and/or the more heterogeneous the boundary conditions of a mechanical object, the more difficult the resulting (test) task will be.

The more confirmation the formulated hypotheses will have, the more validity of the competence model presented here can be relied upon.

40.7 Preliminary Results

Initial surveys conducted to test the competence model concentrate on the partial model of statics with its four subdimensions. An EM competence test developed by the researchers was applied as the main instrument for the surveys. In addition, a background questionnaire on learning opportunities and study conditions was provided. A short version of the IST-2000 R (Liepmann et al. 2007) was used in partial random samples for discriminant/convergent validation (verbal memory retention, calculating, spatial sense).

40.7.1 Description of Sample and Scaling Approach

The pilot phase of the summative and formative tests was conducted with a random sample of 278 students attending courses at universities of applied science and research universities in different locations. The students worked on booklets of 32 items each, arranged according to the "incomplete bloc design." The resulting data allowed for selecting 80 items of statics as well as 40 items each of the subjects of dynamics and mechanics of materials to be used for the main survey. Some content analyses were additionally carried through in order to learn more about the challenges the 80 test items meant for the students.

The determination of item difficulties necessary for a model validation could not be realized with the aid of the usual maximum likelihood (ML) method as there was a large amount of sample dropouts. The ML method, however, requires a great number of cases (n = 200/item). Instead, the method of explicit parameter calculation according to the principle of a pairwise comparison of the conditional frequency of solutions was applied (cf. Garner and Engelhard 2009). This meant that the frequency of solutions of item j was counted for all items, provided that item i had not been solved $\{i \neq j\}$. After further transformations of the symmetrical matrix resulting thereof, the item parameters of the dichotomous Rasch model can be determined by a comparison. This method turned out to be comparatively robust for the determination of item parameters when it came to high shares of missing values of the data matrix to be analyzed. Thus, first reliable assessments of the pattern quality could be identified.

40.7.2 Results

The following project results are related to the validation of the model as postulated in the research questions in terms of a psychometric validity test in a narrower sense (internal validation) and a content-oriented test with a view to the learning sets

developed in the project (item characteristics determined by difficulty). The sketched data base allows for a preliminary evaluation of the validity of the *statics* model (for more details, cf. Musekamp et al. 2013; Musekamp et al. 2014).

40.7.2.1 Evaluation Objectivity and Model Validity

The test items were rated by a total of nine students of engineering of higher semesters. They used a correction scheme previously developed in cooperation with EM lecturers. According to each item, this scheme encompassed two to four categories representing the degree of "correctness" of the indicated solution in ordinal sequence. About one third of the worked on test booklets were independently assessed twice in order to determine the raters' accordance. A stratified random sample ensured that each of the 15 different test item booklets was represented with the same probability ($p = 1/15$) and that both the lower and the upper competence area of the participants were considered. The analyses revealed some items with still considerable problems in terms of evaluation objectivity (these problems were solved during the main study by applying a more systematic rating design with focal correction points for all persons involved in the corrections and by a computer-aided correction). However, as soon as the most problematic items were eliminated, a sufficient number of items could be used for the first analysis of validities.

These validities were realized with the aid of graphic model validity tests for all four subdimensions of the statics model. Two random subsamples were scaled independently from each other, and the resulting item parameters were compared. The dimensions of abstraction and evaluation did not show any deviations from the assumption of the Rasch model, i.e., that item parameters are identical in both random subsamples (independence of random samples from item parameters). As for the dimensions of formulating and calculating, one and three items, respectively, had to be excluded from further processing due to a violation of the model assumptions (cf. Musekamp et al. 2014). Further quality criteria of the instrument could so far not be determined with the aid of the piloting data due to the booklet design (above all selectivity and reliability measurement).

40.7.2.2 Correlations Between the Four Process Dimensions in the Statics Model

The presumption of the EM model that EM competence consists of four distinguishable cognitive processes – abstracting, formulating, calculating, and evaluating – is tendentially backed up by the pilot phase data. The person parameters between the four dimensions correlate in a low to medium way (−.05–33, cf. Table 40.1). So far this disfavors a uniform overall construct of EM competence (general factor model) and favors the differentiated KOM-ING EM model.

Table 40.1 Correlations between the four *process dimensions in the statics model*

		EM dimensions			
		(1)	(2)	(3)	(4)
EM dimensions	(1) Abstract	–	.16	.23	−.28
	(2) Convert		–	.33	−.05
	(3) Solve			–	−.01
	(4) Evaluate				–

Table 40.2 Correlations between EM competence and general cognitive abilities (IQ)

		EM dimensions			
		Abstract	Convert	Solve	Evaluate
Intelligence	Verbal memory retention	.026	.124	.026	.085
	Figurative memory retention	.153*	−.028	−.011	.060
	Drawing figurative conclusions	.017	.032	−.030	−.023
	Drawing verbal conclusions	.283**	.092*	.098*	.219**
	Drawing numerical conclusions	.165**	.000	.086*	.081

* = p<.05, ** = p<.01

40.7.2.3 Correlations Between EM Competence and General Cognitive Abilities (IQ)

Calculations on the discriminant validity of the model additionally point at a far-reaching independence of EM abilities from a general intelligence construct. The major interrelationships can be identified in terms of the linguistic shares of intelligence which moderately correlate with the dimensions of abstraction and evaluation of the EM model (cf. Table 40.2). However, these results have to be very cautiously interpreted due to a so-far sparse amount of data and partly minor reliabilities of the IQ subscales “verbal” and “drawing numerical conclusions.”

40.8 Conclusions

At the time of the pilot phase, the suitability of the instrument was not yet safeguarded to a satisfactory extent due to its psychometric properties. Above all, the evaluation objectivity did not yet meet the expectations. The raters were therefore considerably better trained for the main survey with the aid of empirical answers given by the students. This was not yet possible for the pilot phase due to the tough time schedule. A further fine-tuning of the assessment scheme is also likely to improve objectivity. At the same time, the testing time, which was too short, was identified as a possible reason for the generally too demanding degree of difficulty of items. Therefore, it is expected that targeted changes in items and a cut in test booklets may also further improve the model validity.

Nevertheless, it turned out that, at the time of the pilot phase, the theoretical background of the instrument was promising (above all the developed teaching content hierarchies, LSH) and that it revealed a formative diagnostic potential. First, all involved EM experts agreed to a large extent to the way in which test items should be allocated to the levels of the developed LSH. Second, the feature LSH prerequisites and the item difficulties revealed a common variance of around 20 %, although the accuracy of the estimate of the item parameters and the objectivity at the time of the rating were still subjects to further improvement. A very remarkable finding was the low accordance of two raters assessing characteristics of the EM test items that can be explained by the individual expertise of each rater: the differing assessments carried out by a lecturer with long years of teaching experience and an expert without EM teaching experience offers the opportunity to answer the question why students consider EM items to be more difficult than EM lecturers do. These results also indicate that the selected theoretical approach will be well suitable for a subsequent modeling of empirically sustainable competence levels.

If the validity of the aspired interpretation of test values within the framework of the main survey will continue to develop in a favorable way, prospects are good that LSH and the survey tool will permit assessment-aided teaching in the future. Based on the hierarchy of teaching contents, teachers are able to develop theoretically and empirically underpinned pedagogical and didactical concepts. Thus, hierarchically higher placed teaching aims may alternate with lower placed aims in order to interweave detailed skills with overview knowledge. The developed EM model thus allows this orientation in the teaching/learning process by an interaction of teaching content hierarchies and the assessment items. The model reveals where the course is formally located, the teaching content hierarchy underpins this with material information and the test items indicate the students' current knowledge in various fields as well as the contents they still have to learn.

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Chapter 41
Modeling and Measurement of Teacher Competence: Old Wine in New Skins?

Eveline Wuttke and Jürgen Seifried

41.1 Introduction

Lately there has been an increasing discussion on teaching quality and teachers' professional competence (e.g., Cochran-Smith 2001). Current research on teaching and instruction highlights the significance of teachers' competence for learners' achievement. It is assumed that they have a crucial influence on students' learning processes and outputs (Hattie 2009; Kunter et al. 2013; Lipowsky et al. 2009). Studies particularly highlight the relevance of teachers' domain-specific professional knowledge, namely, their content knowledge (CK) and pedagogical content knowledge (PCK) (Baumert et al. 2010; Hill et al. 2005). Linked to the competence debate, there is a shift from input to output orientation. Whereas in connection with input orientation results of education are steered via the input (e.g., guidelines and curricula), output orientation relies on measurable learning results. The outcome debate is complex, though, because goals and outcomes of teacher education programs have to be fixed and are underpinned by values that quite often do not have an empirical basis and cannot be settled empirically (Cochran-Smith 2002). Nevertheless, international comparative studies such as the Teacher Education and Development Study in Mathematics (TEDS-M) and the Mathematics Teaching in the twenty-first century study (MT21) have revealed that teachers often lack central competence facets (cf. Blömeke et al. 2008, 2010). Such findings suggest that teacher education programs might fail to prepare student teachers successfully for their future tasks and responsibilities in schools.

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Even if the recent and increasing discussion on output orientation and teacher competencies might seem fairly new, it can be traced back to US publications from the late 1960s and 1970s, then under the label of "competence-based teacher education." This former discussion was characterized by enthusiasm on the one side and severe critique on the other side. Mainly, vague competence definitions, an inflationary use of "competencies," and the lack of an empirical basis were criticized (e.g., Ainsworth 1977; Heath and Nielson 1974). It is furthermore problematic that early CBTE approaches were heavily influenced by behavioristic psychology and characterized by over-specification and fragmentation of learning. Resulting education programs often focused on miniscule and isolated skills (Mulder 2014). Therefore, one goal of this chapter is the analysis of differences between the early and recent discussion lines and (empirical) approaches.

But even if definitions and empirical approaches have changed, it is apparent that in many domains, domain-specific models of teachers' competencies as well as competence measurement instruments and empirical evidence are still scarce (Blömeke et al. 2013; Schmelzing et al. 2013). This is particularly true for the competencies of (prospective) teachers in the field of business and economic education (Beck 2005; Kuhn et al. 2014; Zlatkin-Troitschanskaia et al. 2013). The second goal of this chapter is therefore to provide more insight into competence modeling and measuring in this domain.

In the following section, we will review initial initiatives in CBTE. The focus will be on competence definitions, competence modeling, and measurement. Approaches will be presented and discussed critically (Sect. 41.2). We will then discuss recent initiatives on modeling and measuring teacher's competence, putting the focus on central competence facets (mainly content knowledge and pedagogical content knowledge) and correspondent measurement models. Critical points concerning the earlier approaches of competence-based teacher education are taken up, and it will be emphasized, in what aspects recent approaches can be seen as an improvement (Sect. 41.3). In the fourth section, we will focus on teacher education in business and economic education and discuss examples of modeling and measuring preservice teachers' competence. The chapter will be concluded by a critical discussion and an outlook on the future.

41.2 The Origins: Competence-based Teacher Education (CBTE)

Performance- and competence-based approaches provide statements of what the curriculum is intended to achieve, they guide curriculum design, structure pedagogy, and furnish assessment criteria. The 1960s/1970s discussion in the USA on competence-based teacher education was mainly triggered by a switch to outcome orientation (Hodge and Harris 2012). In turn, the establishment of outcome orientation was due to the need for a firm system yielding predictable results at an

increasingly uncertain time in the USA, followed by an increasing call for transparency and accountability of the public sector and the wish to be able to better control the certification of teacher education (Hodge and Harris 2012; National Health Workforce Planning & Research Collaboration, 2011). In this wake the focus was put on the performance of teachers and on competence-based teacher education (CBTE). This process was accompanied by extensive competence catalogs. At that time, they were loose lists without a clear notion of competence models, and they were hardly ever measured. The latter is true even if the principles to implement CBTE, namely, (1) description of the competencies to be demonstrated by students, (2) clarification of criteria to be employed in assessing competencies, (3) assessment of student's competencies, and (4) description of student's rate of progress (Elam, 1971), clearly include an assessment component.

The competence movement in general was caused by the disconnection between higher education and the labor market. In this course, professional associations called for performance requirements and began to formulate competence profiles (Mulder, 2014). The first formal CBTE programs were rooted in the performance-based teacher education (PBTE) movement in American educational circles in the 1960s, mainly in the area of primary and vocational teacher education (Bowden and Masters 1993). In the late 1960s, CBTE moved from these programs to other professional education programs and then to vocational training programs in Germany. Various other countries followed in the years to come. CBTE penetrated into university contexts as well, accompanied by a focus on outcomes as observable competencies and workplace relevance of the curriculum (Bowden and Masters 1993). And whereas there was some resistance to this innovation, the ideas behind the competence approach were welcomed by a large proportion of senior faculty in higher education (Mulder et al. 2009).

The central feature of CBTE is the observable performance against declared criteria (Houston and Brown, 1975). Quite frequently CBTE and performance-based teacher education (PBTE) are used indiscriminately (interchangeably) in the sense that performance has the same meaning as competence (Field 1979). But this is not the case: Competence is an (internal) prerequisite for performance and cannot be assessed directly. Rather, performance has to be assessed to allow an inference on competence. Demonstrated and assessed performance replaces entry assessments or requirements. In the 1970s, the basis for assessment was the then valid definition of a teacher's role via the three components: knowledge, technique, and style, technique being more performance oriented and including attitudes and traits (Bruce and Miller 1976; Field 1979; Serdenciuc 2013). Quite comparable to the discussion and conceptualization of the so-called Schlüsselqualifikationen (key competencies) in Germany in the 1970s (Mertens 1974) and in some respect comparable to the recent approaches in competence definitions, American educators and researchers have split (and sometimes analyzed) the three components into hundreds of discrete competencies (Field 1979; Houston and Brown 1975). Those, in turn, provided the basis for performance-based teacher education. The underlying rationale being that competent teaching is a behavior, and competencies are behavioral rules that can

be identified, specified, and taught (Joyce 1974). Even if the number of competencies was large, it was considered as being potentially possible to list and teach them all (Ishler and Inglis 1974).

Up to the 1980s, "competence" and "competency" tended to be interpreted narrowly and more behaviorally focused in terms of demonstrable skills or personal attributes (Mulder 2014, National Health Workforce Planning & Research Collaboration 2011; Tuxworth 1989). Throughout the 1970s and 1980s, business and industry adopted the competency approach for workplace recruitment and efficiency. Nowadays it has considerably expanded, deepened, and broadened. Especially a wider range of variables is seen as constituting competence (Cheetham and Chivers 1989; National Health Workforce Planning & Research Collaboration 2011). It there follows more strongly the idea of integrated occupationalism or even a situated professionalism (for a detailed description of the three approaches, see Mulder (2014) and Chap. 1 of this volume). In the recent discussion about teacher competencies, we furthermore find a quite clear consensus on which central facets define teacher competence: The construct is seen as an amalgam, including knowledge (content knowledge, pedagogical knowledge, and pedagogical content knowledge), beliefs, motivational orientations, and self-regulation skills (Krauss et al. 2008; Kunter et al. 2013).

The CBTE approach was severely criticized, even back in the 1970s. One central problem was the multitude of definitions with probably the only commonality of view being that there was no common definition of competence (National Health Workforce Planning & Research Collaboration 2011). Hilbert (1982) uttered doubts that a CBTE-informed program can have the complete list of competencies and unambiguous criteria for implementation and evaluation, their sheer number being an obstacle (e.g., the Florida Catalog of Teacher Competencies listed more than 1000 (Dodl and Schalock 1973), the University of Toledo even more than 2000 competencies (Ishler and Inglis 1974)). There was no sound theoretical rationale provided for the existence of basic teaching competencies; there were only analogies drawn from medicine, law, music, painting, and further domains. Even sufficient analytic reasons for suspecting that such competencies exist were missing (Hilbert 1982). Finally, yet importantly, the lack of empirical foundation was criticized. Not even the importance of basic competencies could be supported with solid evidence (Hilbert 1982). Compared with the proven effects of socioeconomic factors, critics considered the effects of teacher competence as being trivial (e.g., Heath and Nielson 1974). Ainsworth (1977) furthermore criticizes the behaviorist background, the measurable terms being norm referenced and – probably – the objectives most easily capable of definition and measurement predominating.

The prevalent conclusion was that CBTE still lacked (1) conceptual clarity and definition, (2) precise competence models, and (3) a sound empirical foundation based on high psychometric quality of the data.

41.3 New Approaches to Competence-based Teacher Education: Competence Modeling and Measurement as Basis for CBTE

Recent approaches still view CBTE as opposite to content-driven or input-driven programs (Hill and Houghton 2001). Its establishment is mostly accompanied by the replacement of time-based systems with a modular mastery learning perspective. Whereas content-driven programs focus on subject knowledge acquisition and emphasize cognitive skills and abilities, CBTE focuses more strongly on developing key competencies (Serdenciuc 2013; Sturgis and Patrick 2010).

Current modeling approaches mainly draw on the same competence model: Professional teacher competence is composed of professional knowledge as well as beliefs, motivational orientation, and self-regulation (see above, Krauss et al. (2008); Kunter et al. (2013)). Following Shulman (1986) professional knowledge in turn comprises content knowledge (CK), pedagogical knowledge (PK), and pedagogical content knowledge (PCK). In addition, organizational knowledge and consultation knowledge are listed.

Current research on teaching and instruction highlights the significance of teacher quality for learners' achievement. Apart from some singular studies (e.g., Döbrich et al. 2003; Fried 1998; Oser and Oelkers 2001; Schaefers 2002), those studies are of interest that allow an international comparison of teacher education systems (Eurydice 2003, 2004; OECD 2005). In particular, the studies TEDS (Teacher Education and Development Study; Blömeke et al. 2010) and COACTIV (Cognitively Activating Instruction, and Development of Students' Mathematical Literacy; Krauss et al. 2008; Kunter et al. 2013) enhanced the discussion on professional and evidence-based teacher education (Hascher 2011). In this discussion, it is assumed that teachers' competencies have a crucial influence on students' learning processes (Hattie 2009; Kunter et al. 2013; Lipowsky et al. 2009). Studies highlight the relevance of teachers' domain-specific professional knowledge, namely, their content knowledge (CK) and pedagogical content knowledge (PCK) (Baumert et al. 2010; Hill et al. 2005), and provide evidence that teachers' domain-related knowledge significantly affects teaching quality and student achievement (Hattie 2009; Hill et al. 2005). In the German research project COACTIV ("Cognitive Activation in the Classroom"; see Kunter et al. (2013)), teachers' CK and mainly PCK are found to significantly affect student progress in mathematics (Baumert et al. 2010). In the domain of commercial vocational education, evidence is still scarce (Beck 2005; Kuhn et al. 2014; Zlatkin-Troitschanskaia et al. 2013).

Despite the evidence for the relevance of teachers' PCK for learners' achievement, a common conceptualization of this construct does not yet exist (an overview is given by Schmelzing et al. 2013). Prevalent facets are the knowledge of students'

conceptions and the knowledge of multiple representations and explanations which were originally identified by Shulman (1986). While some studies focus on these two facets (e.g., Jüttner and Neuhaus 2012), others consider additional facets such as goals and purposes of teaching (e.g., Rohaan et al. 2009), curriculum aspects (e.g., Geddis 1993), the use of media (e.g., Marks 1990), and the knowledge of tasks as instructional tools (e.g., Krauss et al. 2013).

There is empirical evidence supporting Shulman's assumption (1986) that CK and PCK are two correlated but separable constructs (Krauss et al. 2008). The amount of correlation highly depends on the domain: For structured domains such as mathematics or physical science correlations up to $r = .81$ are found (Blömeke et al. 2008; Krauss et al. 2013; Riese and Reinhold 2012). In less structured domains (e.g., English or German), lower correlations are reported ($r = .40$ to $r = .60$; Blömeke et al. 2011). In business and economic education, CK and PCK correlate with $r = .35$ regarding business administration and $r = .41$ regarding economics (Kuhn et al. 2014). Correlations between the two components are plausible. On the one hand, empirical evidence highlights that prospective teachers who have deficits in CK struggle when it comes to typical teaching activities, e.g., providing explanations, identifying students' misconceptions, or choosing appropriate tasks (Halim and Meerah 2002; Sullivan et al. 2013; Thanheiser 2009). Thus, CK is necessary for the development and application of PCK. On the other hand, it seems that CK alone cannot constitute a solid foundation for cognitive activating teaching (Baumert et al., 2010; Turnuklu and Yesildere 2007), and it is unlikely that further efforts in the subject alone will improve PCK (Sullivan et al. 2013). Hence, there is a consensus that CK is necessary but not sufficient for teachers' PCK development and teaching quality (Baumert et al. 2010; Sullivan et al. 2013).

From an *assessment point of view*, new developments in psychometric theory (e.g., item response theory) advance insights into teacher competence. These are predominantly studies that are launched by supranational organizations (such as the PISA initiative).

Table 41.1 summarizes and compares central features of early and recent approaches to competence orientation, definition, modeling, and measurement.

Whereas the idea of competence-based teacher education has not changed significantly, there is a major progress in various aspects. First, we find an at least tentative consensus regarding the definition and modeling of central competence facets. In earlier approaches, extensive and loose lists of competences were still predominant. Second, the empirical foundation is largely improved. There is a growing body of evidence, predominantly on the state and the effects of CK, PK, and PCK. Third, the data are of increasing psychometric quality. What is still missing, though, is evidence in the domain of business and economic education. First and recent approaches are presented in the following section.

Table 41.1 A comparison of central features of early and recent approaches to competence orientation, definition, modeling, and measurement

Features	Early approaches of CBTE	Recent approaches
Orientation	Outcome/performance against declared criteria, no entry assessment, no specified requirement	
(Central) definition of teacher competencies	Combination of knowledge, techniques (being performance oriented and including attitudes and traits), and style	Professional competence: professional knowledge (CK, PK, PCK, organizational knowledge, and consultation knowledge) plus beliefs, motivational orientation, and self-regulation
Competence model	Loose list of competencies, multitudes of definitions	Extensive list of competencies but common/mainly agreed upon competence model following the abovementioned definition of professional teacher competence (Baumert and Kunter 2011). Knowledge facets follow Shulman (1986; CK, PK, PCK); subcategories especially of PCK are rather heterogeneous in studies
Empirical foundation	Hardly any	Growing body (depending on the domain); central result is the importance of CK and PCK, the correlation of CK and PCK, CK being necessary but not sufficient for PCK development and teaching quality
Sophisticated measurement	None	Growing body of data with high psychometric quality
Measurement and modeling in commercial vocational teacher education	Hardly any	Still scarce

41.4 Modeling and Measuring CK and PCK of Teachers in Business and Economic Education as a Basis for Teacher Education and Training in This Domain

In the following subsections, recent approaches to the measurement of CK and PCK of teachers in business and economic education will be presented. After some general considerations on the measurement of teacher competence (4.1), two studies will be introduced and discussed (4.2).

41.4.1 General Considerations on the Measurement of Teacher Competence

For the measurement of teacher competence, various methods can be applied (Seifried and Wuttke in press). Each is accompanied by specific advantages and disadvantages (see Table 41.2). *Classroom observations* are characterized by high

Table 41.2 Overview on chances and limitations of various methods of competence measurement (Wuttke and Seifried 2012, 181)

Method	Chances	Limitations
Observation	High ecological validity	High amount of resources necessary
Expert interviews	Low amount of resources	Limited by the number of experts and their competence
		Appraisal, not competence measurement
Self-assessment	Low amount of resources	Reflection and verbalization ability of test persons
		Social desirability
		Appraisals, not competence measurement
Test	Objective results	Dependent of the choice of items and their quality
	Low amount of resources	Measuring mostly knowledge
Situated test scenarios (video vignettes)	High ecological validity, complex but controlled situations, standardized test situations, precise focus on specific phenomena possible	No real (classroom) interaction
		High production costs

ecological validity and document classroom interaction and the behavior of all actors in complete complexity. It is furthermore possible to assess competence based on actual performance (Fahrenberg et al. 2007; Prenzel and Allolio-Näcke 2006). A disadvantage – on the other side – is the rather high amount of resources (especially time) that is necessary for the observation (Oser et al. 2009, 2010). *Expert interviews* and *self-assessments* are economical, but they are – strictly speaking – not competence measurement but assess appraisals of participants. Those are not necessarily comparable with actual performance (Oser et al. 2009, 2010; Wuttke and Seifried 2013). Last, competence can be assessed via *tests*. Tests are economical and offer an objective and reliable assessment, but measure mainly knowledge and not competence. Therefore, it is difficult to draw conclusions about actual performance. However, *situated test scenarios* allow competence measurement by creating situations that are close to reality. Test persons have to act almost as they do in reality, their performance can be measured, and their competence inferred. Most frequently such scenarios are presented in videos or video vignettes (short video clips). Videos usually are of real situations, whereas vignettes present fictive scenarios close to reality.

Vignettes demand performance on behalf of the protagonists presented in the scenarios. The advantage is the closeness to real situations without having the whole

complexity of the respective segment of reality (Atria et al. 2006; Barter and Renold 1999; Bloor and Wood 2006; Hughes and Huby 2002; Jüttner and Neuhaus 2010; König and Lebens 2012; McKinstry 2000; Oser et al. 2009, 2010; Seguin and Ambrosio 2002; Veal 2002; Wason et al. 2002). Nevertheless, test persons usually see vignettes as being realistic (Miller und Zhou 2007). Furthermore, vignettes allow controlled repetitions of situations and therefore a standardized test situation. And they can be reanalyzed repeatedly (Pauli and Reusser 2006). Despite the many advantages, some limitations have to be mentioned as well, an analysis of real classroom interaction is not possible due to the prefabricated and reduced scenarios (Atria et al. 2006; Blomberg et al. 2013). And the production of vignettes is rather cost intensive (Atria et al. 2006).

41.4.2 Competence Measurement in Business and Economic Education

As mentioned above, there are hardly any approaches and studies modeling and measuring teacher competence in business and economic education. Recently there are some examples, which will be presented in the following.

41.4.2.1 The ILLEV Study

One of the first approaches of competence measurement in the domain of teacher education for commercial vocational schools was the German ILLEV study (innovative teach-study-network in academic higher education). In the project, the effects of teacher-student professionalization and their knowledge levels and knowledge development in the domain of business and economics are analyzed (cf. Zlatkin-Troitschanskaia et al. 2012). ILLEV focuses on modeling and measuring subject-specific content knowledge and pedagogical content knowledge among students of business and economics as well as of business education (Förster and Zlatkin-Troitschanskaia 2010). In the project competence is modeled featuring professional knowledge together with beliefs, motivational orientation, and self-regulation (Baumert and Kunter 2006; Krauss et al. 2011). A central result of the study is – in line with various other studies in different domains – that content knowledge alone does not lead to professional teacher performance. CK and PCK correlate with $r = .35$ regarding business administration and $r = .41$ regarding economics (Kuhn et al. 2014). CK can be seen as a necessary but not sufficient prerequisite for professional teacher performance. The project furthermore reports strong evidence for the impact of university education on PCK. Kuhn et al. (2014) found that the number of hours spent on courses in business didactics significantly affects prospective teachers' PCK.

41.4.2.2 The PEC (Professional Error Competence) Study

A recent cross-sectional study situated in a teacher-training program for teachers in business and economic education uses video vignettes to provide evidence on the professional error competence of prospective teachers. Again, professional teacher competence is seen as interaction of professional knowledge together with beliefs, motivational orientation, and self-regulation (Krauss et al. 2011; Baumert and Kunter 2006). Professional knowledge comprises content knowledge and pedagogical content knowledge (Shulman 1986). But against the background of learning from errors, we focus on specific facets of content knowledge and pedagogical content knowledge which together represent the construct of Professional Error Competence (PEC) of teachers: PEC represents a teacher's ability to diagnose student errors and identify their potential causes (content knowledge), as well as to use them constructively (in the sense of creating opportunities to learn) in the classroom (pedagogical content knowledge) (Seifried and Wuttke 2010). PEC is seen as a prerequisite to support students' learning from errors. To be able to do this, teachers need a specific subset of competencies:

1. *Knowledge about domain-specific student errors*: To identify student errors, teachers need domain-specific content knowledge as well as knowledge about common student errors and potential causes for student errors.
2. *Strategies for handling student errors*: In order to foster learning processes in error situations, teachers need to be able to deal with errors in a constructive way and give elaborate feedback. Thus, they require a broad variety of potential strategies to deal with errors in an adaptive way.
3. *Beliefs on the possibilities of learning from errors (the benefit of student errors)*: Briefly, an error can be seen as something that should be avoided or even sanctioned during class (error prevention didactics) or as an opportunity to learn (error-friendly beliefs). To foster learning from errors, teachers should take the latter view.

PEC was assessed by using a sample of $n = 287$ (prospective) teachers (i.e., student teachers, respectively, bachelor and master students, preservice teachers, and in-service teachers) in the domain of accounting (Seifried and Wuttke 2010; Türling 2014; Türling et al. 2012; Wuttke and Seifried 2013 – the joint research project was funded by the German Federal Ministry of Education and Research under grant no. 01JH0921 and 01JH0922). The study followed a mixed-method approach (Tashakkori and Teddlie, 2010): Video vignettes (i.e., short video sequences representing typical error situations in accounting lessons) were used as stimuli for situational decisions on action and combined with semi-structured interviews. In addition, participants were asked to work on a paper-pencil test (correcting errors in a student's assignment) and to answer a questionnaire (self-perception of PEC). In this way, it was possible to assess the participants' knowledge about domain-specific errors, their strategies for handling errors, and their error beliefs. The following findings are of particular interest:

1. *Knowledge about domain-specific student errors (CK):* The ability to identify and correct errors (performance measures based on the video vignette test and the paper-pencil test) of both student and preservice teachers is rather low. Apparently knowledge relevant for successful teaching is missing. In contrast, in-service teachers score rather high in these tests, consequently generating significant differences between the test groups with a high effect size (explained variance: 27 %). Analysis of self-perception reveals that student and preservice teachers tend to overestimate their own competence, whereas in-service teachers perceive themselves in a more realistic way.
2. *Strategies for handling errors (PCK):* To analyze how the respondents handle errors and give feedback, quality measures from teaching-learning research were used (e.g., *structuring*, *cognitive activation*, *adaptivity*, *and consolidation*; cf. e.g., Brophy, 1999; Clausen, Reusser, & Klieme, 2003; Fraser et al., 1987; Hattie, 2009; Helmke, 2010; Seidel & Shavelson, 2007). Again significant differences in favor of in-service teachers could be found, generating high effect sizes. This is in particular true for aspects strongly related to pedagogical content knowledge. For example, with regard to the category "cognitive activation," in-service teachers achieve both – a higher rate of using subcategories like creating a cognitive conflict or leading their students to generate ideas or questions as well as a higher level of elaborated reasoning why to use those strategies in an error situation (explained variance: 32 %). Overall, the in-service teachers clearly outperform the other groups. Concerning their self-perception, the findings are quite similar to those described above for the knowledge facet.
3. *Beliefs about the chances of learning from errors:* The (prospective) teachers' beliefs can be described as "error-friendly," i.e., inherent benefits of student errors prevail instead of perceiving them as obstacles. No significant group differences were found.

The correlation between PK and PCK is $r = .50$ and therefore consistent with results achieved in similar studies. The constructs can be seen as closely related but empirically separable.

To summarize, the results indicate student teachers' and preservice teachers' PEC deficits. This is true for the ability to identify errors as well as the ability to handle student errors adequately and foster students' learning from errors. Since in-service teachers perform much better, we can assume that PEC can be developed in learning processes. So far, however, opportunities to learn and acquire competence at both the university and practical training level seem to be rather inefficient with regard to PEC. This is particularly problematic for teachers in practical training because they already have to teach on their own authority. If – in the beginning – they are not able to identify student errors and to handle them adequately (i.e., give supporting feedback), at least some student cohorts might not learn from errors.

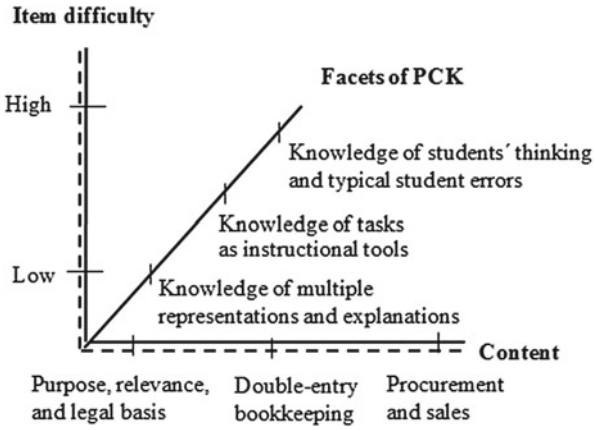

Fig. 41.1 Dimensional model of CK and PCK items (Berger et al. 2013)

41.4.2.3 Competence Testing

To validate the results achieved in the vignette study, PCK and CK (including aspects of the professional error competence) were assessed with a paper-pencil test using a larger sample (Bouley et al. 2015, Berger et al. 2015, Fritsch et al. 2015). The items of the test instrument relate to a three-dimensional domain-specific model (Fig. 41.1) and cover (1) different facets of PCK, (2) different content areas, and (3) vary in item difficulty. The dotted line indicates the dimensions relevant for CK items, while the solid line indicates those relevant for PCK items (for more details see Berger et al. (2013); Berger et al. 2015).

The content areas include (1) purpose, relevance, and legal basis of accounting, (2) system of double-entry bookkeeping, and (3) procurement and sales (including the system of value-added tax). They are necessary for a broad understanding of accounting and were generated with the help of expert interviews. The difficulty of an item is specified using the results of pretests. Two levels of item difficulty are distinguished. PCK test items cover three competence facets which are particularly relevant for the quality of accounting lessons (see above; Bouley et al. 2015; Berger et al. 2015): (1) knowledge of students' conceptions and typical student errors (12 items), (2) knowledge of tasks as instructional tools (12 items), and (3) knowledge of multiple representations and explanations (12 items).

The total sample consists of $n = 1158$ prospective teachers in a bachelor or master program of business and economic education at 24 German universities.

Test scores are calculated as the percentage of correctly solved items of each knowledge component. Bachelor and master students on average solve 58 % of the CK items and 52 % of the PCK items. Master students' test scores in CK are slightly higher than those of bachelor students; however, this difference is not significant. For PCK there is a significant difference between bachelor and master students' test scores. However, the effect size is rather small. Furthermore, there is a great variance between test scores of students from different universities. The mean CK scores at the 24 universities vary between 0.74 and 0.39. These differences are

significant, and the place of study has a medium effect on prospective teachers' CK scores. Regarding PCK the mean scores per university (range: 0.42–0.65) also show significant differences. Again, the place of study has a medium effect on prospective teachers' PCK scores. Hence, university education seems to have an effect on prospective teachers' knowledge (for more details see Fritsch et al. (2015)).

To summarize, again the results indicate student teachers' deficits in CK and PCK. Opportunities to learn and acquire competence at both the university and practical training level seem to be partly inefficient and rather random. If CBTE is taken seriously, this evidence provides clues for a modification in teacher education. If such modification can be successful was analyzed with the help of a training study that is reported elsewhere (Seifried et al. 2015).

41.5 Conclusions

Competence-based (teacher) education – in the sense of an alternative approach to input orientation – was central in earlier approaches and is central in the recent discussion again. In the past and today, (more) accountability in (teacher) education is seen as crucial issue. To design teacher education programs in total or educational measures in detail and to assess if goals are reached, though, a competence measurement strategy on the one hand and sophisticated competence models and respective measurement methods on the other hand are essential. Against the background of competence orientation on all levels of teacher education programs, competence modeling and competence measurement are nowadays done as a matter of course. But this was not common in the past, where loose and extensive lists of competences were formulated and evidence of their importance was seldom provided. Meanwhile a tentative consensus on central competence facets has been reached, mainly in the wake of studies that focus on the international comparison of teacher education systems (Eurydice 2003, 2004; OECD 2005). In particular the studies TEDS (Blömeke et al. 2010) and COACTIV (Krauss et al. 2008; Kunter et al. 2013) enhanced the discussion on professional and evidence-based teacher education (Hascher 2011). Furthermore, we find a growing body of empirical evidence based on sophisticated psychometric modeling and measurement that allows to assess teachers' competence and to find weaknesses and strengths in teacher education programs.

Nevertheless, evidence in the domain of business and economic education is still scarce. This is where our own studies as well as ILLEV step in. As shown above they measure and train central facets of teacher competence on the basis of a mainly agreed upon competence model by using either a mixed method or a test approach. Competence deficits identified in initial studies are starting points for teacher trainings.

The conclusion must be that there is progress when we compare earlier and recent approaches of defining and measuring teachers' competence. This is found mainly in the area of competence modeling and measurement. But in some respects,

the recent discussion resembles old wine in new skins because, again, the competence lists are getting longer. And it raises the question when and how all these competences should be acquired in the course of a teacher-training program with limited time. Subsequently the question emerges which competences are central – if there has to be a choice (e.g., due to time limits in training programs). And an interesting yet unsolved question is, if there is a possibility to compensate between competence facets, if one facet is missing, can another one step in? Are they connected in an additive or a multiplicative way? And finally: what are appropriate ways to develop not only teachers' but also learners' competence?

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Chapter 42
Competency-Based Medical Education and its Competency Frameworks

Olle ten Cate

42.1 Introduction

Competency-based medical education is now, a decade and a half into the twenty-first century, probably the most widely used curricular terminology for clinical education of physicians and for many other professions in health care. While 'problem-based learning' was the medical education buzzword in the 1980s and 1990s, it now seems to be 'competency-based education'. That was not always the case. A recent *PubMed* search of competency-based education and some synonyms, in titles or abstracts (performed July 2015), showed that 81 % of the about 3500 papers was published this century, 19 % in the twentieth century and only 8 % before 1990.

This chapter elaborates on how CBME has been defined; where it came from; how the immense popularity in medicine, in contrast with other domains, can be understood; and why, at the same time, controversies and confusions exist. The world of CBME is dynamic, and ongoing new developments have been stimulated by the ups and downs of the movement.

What is understood by the concept of competency-based medical education? Many authors have attempted to clarify the rather fuzzy concepts of competence and competency. Multidimensional typologies of competence have been described, one of which distinguishes a conceptual–operational axis versus a personal–occupational axis. Medical competence would be situated primarily in the functional quadrant of this general typology, being both operational and occupational.

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M. Mulder (ed.), *Competence-based Vocational and Professional Education*, Technical and Vocational Education and Training: Issues, Concerns and Prospects 23, DOI 10.1007/978-3-319-41713-4_42

But many other dimensions have been discussed extensively in the literature, such as context-free versus context-specific, knowledge versus capability, behaviour versus ability, learnable versus unchangeable and performance-oriented versus development-oriented (Ten Cate 2014b).

The medical education community has also defined competence in many different ways (Fernandez et al. 2012). A recent authoritative definition captures what the majority of medical educators would probably agree with: 'The habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and community being served' (Epstein and Hundert 2002).

The word 'competency', simply meaning 'the ability to do something successfully or efficiently' (The Concise Oxford English Dictionary 2005), has nevertheless led to confusion among educators. Programmes based on 'competency-based education' did not always live up to their promise and the concept of competency has been redefined many times. Early this century the Dutch Educational Council proposed a sensible, literature-derived definition of competency that includes six features: *specific*, *integrative*, *durable*, *focused on performance*, *learnable* and *mutually dependent* (Van Merriënboer et al. 2002). This accords with a more recent definition in the medical domain by Albanese and colleagues, who add that competencies should reflect *external expectations* and lead to *behaviour that is measurable using absolute standards*, i.e. independent of other learners (Albanese et al. 2008). Other authors have stressed that the ability to act successfully is to some extent context dependent (Ten Cate and Billett 2014). A person can possess a competency during the day in a well-equipped hospital, but not during the night in a remote rural area with little support. If the ability to perform well in the full scope of the medical profession equates with 'medical competence', then the proposed definition of *a medical competency* is 'a learnable, durable, and measurable ability to execute a specific, integrative task that is a part of the full range of tasks that constitute the medical profession. It is a generalized ability that may vary somewhat, depending on the context'. (Ten Cate 2014b)

The adjective 'competent' describes a person who has 'the ability to do something', i.e. who has a 'competency'. 'Competent' also has the connotation of a legal right to act or judge, as has been stressed by others (Mulder 2014). The authorization to judge or act can be considered dependent on the demonstration of sufficient mastery of a competency. In this sense, a competent person *can* act, but also has an *authority* or *right* to act and may be bestowed with a *duty* to act, implying that unqualified persons would not have this right or duty (The Concise Oxford English Dictionary 2005). This is a relevant addition for professionals with a legal responsibility, among whom are medical doctors. Their licence provides rights and duties, bound to their competence.

'Competency-based medical education' evolves from its founding concepts of competency and competence. Based on a literature review, Frank and colleagues state that CBME is 'an approach to preparing physicians for practice that is fundamentally oriented to graduate outcome abilities and the organization around

competencies derived from an analysis of societal and patient needs. It de-emphasizes time-based training and promises a greater accountability, flexibility, and learner-centeredness' (Frank et al. 2010). While this is strictly not a definition but rather a circumscription, it includes a new element that distinguishes CBME programmes from other programmes: time independence. This is indeed fundamental to CBME, which can be argued for different reasons. If competency-based education focuses on certifying or graduating students as soon as they are competent, time in training loses some of its relevance. Theoretically, students who start education on a high level of capability and prior experience should arrive at a predefined level of competence earlier than those who start with little experience. Education in settings that are workplaces instead of classes is already highly individualized. Given the natural difference in workplaces, learning experiences will be different too. This brings us to two defining features of competency-based medical education: (1) its focus on outcomes formulated as specific competencies and (2) its independence of time in training.

Based on definitions of 'competence', 'competency', and 'competent', competency-based medical education can hence be defined as 'Education for the medical profession that is targeted at a fixed level of proficiency in one or more medical competencies'. The individualized and time-independent nature of CBME stems naturally from this definition, as education is finished when a preset level of competence is reached rather than after a fixed number of years. In this definition CBME is not restricted to workplace learning, but in practice the approach is specifically useful in settings that allow for individualized learning and flexibility such as the clinical workplace.

Training medical professionals requires a long trajectory that includes undergraduate and postgraduate training. While worldwide the medical education continuum is organized quite differently (Wijnen-Meijer et al. 2013). Students usually spend 6–7 years in undergraduate medical education after secondary education to become a physician and an additional 3–6 years in postgraduate training to become a specialist. This full period is increasingly viewed as one coherent phase (Aschenbrener et al. 2015), as in the Western world, almost all doctors with a medical degree move into postgraduate residency training, and the undergraduate medical degree does not allow for much, if any, unsupervised medical practice (Ten Cate 2014a, b, c). The CBME movement, initiated by the question: *what must independent medical practitioners be able to do?* was initially just focused on the objectives of postgraduate medical training. However, over time, undergraduate university programmes, regulated by national documents of medical education objectives at the MD level, have adopted postgraduate competency frameworks and translated these to undergraduate programmes (Bürgi et al. 2008; Frank et al. 2014; Van Herwaarden et al. 2009).

Note: Parts of this section are drawn from the author's contribution to the 2014 edition of *The Wiley-Blackwell Encyclopedia of Health, Illness, Behavior, and Society* (Ten Cate 2014b).

42.2 History and Justification of CBME

In 1978, Samuel Shem wrote the *The House of God*, a satiric account of the medical trainee life in a large training hospital that unveiled a thus far unprecedented hidden curriculum description. It alarmed the public about the quality of medical training. Next, a US college girl's death in 1984 because of suboptimal care in a teaching hospital led to Grand Jury's condemnation of interns' and junior residents' permission to work unsupervised (Ludmerer 2014). Several investigations led to the conclusion that hospitals are often unsafe for patients. The measurement of quality, safety and harm in health care has increased substantially since the 1970s and has made both the profession and the public aware of poor quality and frequent mishaps and of the need for systematic quality improvement (Baker et al. 2004; Kohn et al. 2000; Marciniak et al. 1998). This not only led to reducing the working hours of residents in training in the USA to no more than 80 per week but also stirred a movement to better define and assess competencies of medical graduates and specialists and to supervise them more closely.

Next, a more educational development forms the background of the emergence of CBME. In the same year Shem's book was published, an early description of competency-based medical education was coined by McGaghie and colleagues. The authors distinguish it from the traditional subject-oriented and integrated curricula by its organization around *functions required for the practice* of medicine in a specified setting, with the conviction that *all medical students can master* the basic performance objectives and the justification that learning and learning processes *can then be empirically tested*. 'The intended outcome is a health-professional who can practice medicine at a defined level of proficiency, in accord with local conditions, to meet local needs' (McGaghie et al. 1978). This was different than the usual description of educational objectives. Outcome or competence-based approach has an even stronger emphasis on desired qualities that should all be attained by every learner at graduation. Rooted in mastery learning (Bloom 1968; Caroll 1963; Kulik et al. 1990), this approach led to what the US Accreditation Council for Graduate Medical Education (ACGME) called the *Outcome Project* in postgraduate medical education (Swing 2007), drawing from the work of Harden, McGaghie and others (Harden et al. 1999; McGaghie et al. 2014). The reason to strive for mastery is that the community simply does not accept physicians to make mistakes that may harm patients, even if the knowledge and technical possibilities of health care have tremendously increased and the ability for physicians to master all has become less self-evident. Traditional training of physicians in hospitals, by just immersing them in the daily routine of practice, does not suffice to produce the twenty-first century medical workforce needed.

Competency-based medical education has therefore been called a paradigm shift (Carraccio et al. 2002) and one of the most important developments in clinical education (Long 2000). A recent *charter for clinical educators* stresses the importance attached to it (Carraccio et al. 2016).

42.3 Models of CBME: *CanMEDS*, the *ACGME Framework* and *Tomorrows Doctors*

Against this background, three dominant models of competency-based medical education were developed: one in Canada, one in the USA and one in the UK.

42.3.1 CanMEDS Framework

The Canadian model is the most well-known framework and has been adopted in many countries across the globe. The *Canadian Medical Education Directives for Specialists* (Frank (Ed) 2005; Frank and Jabbour 1996; Frank et al. 2014) or *CanMEDS competency framework* consists of seven roles for the physician. The framework was first constructed in 1996 and has now seen three revisions. The CanMEDS 2015 framework (after versions 2000 and 2005), released in October 2015, has basically retained the same core roles that were presented in 1996, while one role has been renamed (from 'manager' to 'leader'). The seven roles of the physician are elaborated with 14–39 key concepts per role, 2–5 key competencies per role and 8–27 enabling competencies per role (categorized under key competencies), making up 161 key concepts, 28 key competencies and 116 enabling competencies. Table 42.1 summarizes the CanMEDS 2015 framework.

42.3.2 The ACGME Framework

The ACGME framework was developed in 1998 to cope with fragmentation and lack of clarity in existing postgraduate programmes (Batalden et al. 2002) and to enhance assessment of resident performance and increase utilization of educational outcomes for improving resident education (Swing 2007). The ACGME framework exists of six 'general competencies' (patient care, medical knowledge, practice-based learning and improvement, interprofessional and communication skills, professionalism, systems-based practice), each with a series of 'constituent components' or sub-competencies, totalling 41 (Swing 2007). Note that the terminology as used by ACGME is quite remote from what usually are called competencies (i.e. abilities of individuals); we would now rather call these (e.g. patient care) 'domains of competence'. In a recent initiative of the Association of American Medical Colleges, a new taxonomy has been proposed (Englander et al. 2013), as well as a new description of the general competencies of the physician including two additional domains of competence (interprofessional collaboration and personal and professional development). Table 42.2 shows this expanded ACGME framework.

Table 42.1 The draft CanMEDS 2015 framework

Roles ($N=7$)	Key competencies (all) ($N=28$). *Physicians are able to:*	Enabling competencies (examples) ($N=116$). *Physicians are able to*:
Medical expert	Practice medicine within a defined clinical scope of practice and expertise	Apply knowledge of the clinical and biomedical sciences relevant to their discipline
	Perform a patient-centred clinical assessment and establish a management plan	Establish a patient-centred management plan
	Plan and perform procedures and therapies for the purpose of assessment and/or management	Determine the most appropriate procedures or therapies
	Establish plans for ongoing care and, when appropriate, timely consultation	Implement a patient-centred care plan that supports ongoing care, follow-up on investigations, response to treatment and further consultation
	Actively contribute, as an individual and as a member of a team providing care, to the continuous improvement of health-care quality and patient safety	Adopt strategies that promote patient safety and address human and system factors
Communicator	Establish professional therapeutic relationships with patients and their families	Respond to a patient's non-verbal behaviours to enhance communication
	Elicit and synthesize accurate and relevant information, incorporating the perspectives of patients and their families	Use patient-centred interviewing skills to effectively gather relevant biomedical and psychosocial information
	Share health-care information and plans with patients and their families	Disclose harmful patient safety incidents to patients and their families accurately and appropriately
	Engage patients and their families in developing plans that reflect the patient's health-care needs and goals	Facilitate discussions with patients and their families in a way that is respectful, non-judgmental and culturally safe
	Document and share written and electronic information about the medical encounter to optimize clinical decision-making, patient safety, confidentiality and privacy	Communicate effectively using a written health record, electronic medical record or other digital technology
Collaborator	Work effectively with physicians and other colleagues in the health-care professions	Establish and maintain positive relationships with physicians and other colleagues in the health-care professions to support relationship-centred collaborative care
	Work with physicians and other colleagues in the health-care professions to promote understanding, manage differences and resolve conflicts	Show respect toward collaborators
	Hand over the care of a patient to another health-care professional to facilitate continuity of safe patient care	Determine when care should be transferred to another physician or health-care professional

(continued)

Table 42.1 (continued)

Roles ($N=7$)	Key competencies (all) ($N=28$). *Physicians are able to:*	Enabling competencies (examples) ($N=116$). *Physicians are able to*:
Leader	Contribute to the improvement of health-care delivery in teams, organizations and systems	Contribute to a culture that promotes patient safety
		Allocate health-care resources for optimal patient care
	Engage in the stewardship of health-care resources	Demonstrate leadership skills to enhance health care
	Demonstrate leadership in professional practice	Manage a career and a practice
	Manage career planning, finances and health human resources in a practice	
Health advocate	Respond to an individual patient's health needs by advocating with the patient within and beyond the clinical environment	Work with patients and their families to increase opportunities to adopt healthy behaviours
	Respond to the needs of the communities or populations they serve by advocating with them for system-level change in a socially accountable manner	Contribute to a process to improve health in the community or population they serve
Scholar	Engage in the continuous enhancement of their professional activities through ongoing learning	Develop, implement, monitor and revise a personal learning plan to enhance professional practice
	Teach students, residents, the public and other health-care professionals	Plan and deliver a learning activity
		Critically evaluate the integrity, reliability and applicability of health-related research and literature
	Integrate best available evidence into practice	
	Contribute to the creation and dissemination of knowledge and practices applicable to health	Contribute to the work of a research programme
Professional	Demonstrate a commitment to patients by applying best practices and adhering to high ethical standards	Demonstrate a commitment to excellence in all aspects of practice
	Demonstrate a commitment to society by recognizing and responding to societal expectations in health care	Demonstrate accountability to patients, society and the profession by responding to societal expectations of physicians
	Demonstrate a commitment to the profession by adhering to standards and participating in physician-led regulation	Participate in peer assessment and standard setting
		Promote a culture that recognizes, supports and responds effectively to colleagues in need
	Demonstrate a commitment to physician health and well-being to foster optimal patient care	

Table 42.2 Competency framework of the Accreditation Council of Graduate Medical Education, as revised and expanded by the Association of American Medical Colleges (Robert Englander et al. 2013)

Domain	Competency	Competencies
Patient care	Provide patient-centred care that is compassionate, appropriate and effective for the treatment of health problems and the promotion of health	Perform all medical, diagnostic and surgical procedures considered essential for the area of practice
		Gather essential and accurate information about patients and their conditions through history taking, physical examination and the use of laboratory data, imaging and other tests
		Organize and prioritize responsibilities to provide care that is safe, effective and efficient
		Interpret laboratory data, imaging studies and other tests required for the area of practice
		Make informed decisions about diagnostic and therapeutic interventions based on patient information and preferences, up-to-date scientific evidence and clinical judgement
		Develop and carry out patient management plans
		Counsel and educate patients and their families to empower them to participate in their care and enable shared decision-making
		Provide appropriate referral of patients including ensuring continuity of care throughout transitions between providers or settings and following up on patient progress and outcomes
		Provide health-care services to patients, families and communities aimed at preventing health problems or maintaining health
		Provide appropriate role modelling
		Perform supervisory responsibilities commensurate with one's roles, abilities and qualifications

(continued)

Table 42.2 (continued)

Domain	Competency	Competencies
Knowledge for practice	Demonstrate knowledge of established and evolving biomedical, clinical, epidemiological and social–behavioural sciences, as well as the application of this knowledge to patient care	Demonstrate knowledge of established and evolving biomedical, clinical, epidemiological and social–behavioural sciences, as well as the application of this knowledge to patient care
		Demonstrate an investigatory and analytic approach to clinical situations
		Apply established and emerging biophysical scientific principles fundamental to health care for patients and populations
		Apply established and emerging principles of clinical sciences to diagnostic and therapeutic decision-making, clinical problem-solving and other aspects of evidence-based health care
		Apply principles of epidemiological sciences to the identification of health problems, risk factors, treatment strategies, resources and disease prevention/health promotion efforts for patients and populations
		Apply principles of social–behavioural sciences to provision of patient care, including assessment of the impact of psychosocial and cultural influences on health, disease, care seeking, care compliance and barriers to and attitudes toward care
		Contribute to the creation, dissemination, application and translation of new health-care knowledge and practices

(continued)

Table 42.2 (continued)

Domain	Competency	Competencies
Practice-based learning and improvemen **t**	Demonstrate the ability to investigate and evaluate one's care of patients, to appraise and assimilate scientific evidence and to continuously improve patient care based on constant self-evaluation and lifelong learning	Demonstrate the ability to investigate and evaluate one's care of patients, to appraise and assimilate scientific evidence and to continuously improve patient care based on constant self-evaluation and lifelong learning
		Identify strengths, deficiencies and limits in one's knowledge and expertise
		Set learning and improvement goals
		Identify and perform learning activities that address one's gaps in knowledge, skills and/or attitudes
		Systematically analyse practice using quality improvement methods and implement changes with the goal of practice improvement
		Incorporate feedback into daily practice
		Locate, appraise and assimilate evidence from scientific studies related to patients' health problems
		Use information technology to optimize learning
		Participate in the education of patients, families, students, trainees, peers and other health professionals
		Obtain and utilize information about individual patients, populations of patients or communities from which patients are drawn to improve care
		Continually identify, analyse and implement new knowledge, guidelines, standards, technologies, products or services that have been demonstrated to improve outcomes

(continued)

Table 42.2 (continued)

Domain	Competency	Competencies
Interpersonal and communication skills	Demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families and health professionals	Communicate effectively with patients, families and the public, as appropriate, across a broad range of socio-economic and cultural backgrounds
		Communicate effectively with colleagues within one's profession or specialty, other health professionals and health-related agencies
		Work effectively with others as a member or leader of a health-care team or other professional group
		Act in a consultative role to other health professionals
		Maintain comprehensive, timely and legible medical records
		Demonstrate sensitivity, honesty and compassion in difficult conversations, including those about death, end of life, adverse events, bad news, disclosure of errors and other sensitive topics
		Demonstrate insight and understanding about emotions and human responses to emotions that allow one to develop and manage interpersonal interactions
Professionalism	Demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles	Demonstrate compassion, integrity and respect for others
		Demonstrate responsiveness to patient needs that supersedes self-interest
		Demonstrate respect for patient privacy and autonomy
		Demonstrate accountability to patients, society and the profession
		Demonstrate sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities and sexual orientation
		Demonstrate a commitment to ethical principles pertaining to provision or withholding of care, confidentiality, informed consent and business practices, including compliance with relevant laws, policies and regulations

(continued)

Table 42.2 (continued)

Domain	Competency	Competencies
Systems-based practice	Demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care	Work effectively in various health-care delivery settings and systems relevant to one's clinical specialty
		Coordinate patient care within the health-care system relevant to one's clinical specialty
		Incorporate considerations of cost awareness and risk–benefit analysis in patient and/or population-based care
		Advocate for quality patient care and optimal patient care systems
		Participate in identifying system errors and implementing potential systems solutions
		Perform administrative and practice management responsibilities commensurate with one's role, abilities and qualifications
Interprofessional collaboration	Demonstrate the ability to engage in an interprofessional team in a manner that optimizes safe, effective patient- and population-centred care	Work with other health professionals to establish and maintain a climate of mutual respect, dignity, diversity, ethical integrity, and trust
		Use the knowledge of one's own role and the roles of other health professionals to appropriately assess and address the health-care needs of the patients and populations served
		Communicate with other health professionals in a responsive and responsible manner that supports the maintenance of health and the treatment of disease in individual patients and populations
		Participate in different team roles to establish, develop and continuously enhance interprofessional teams to provide patient- and population-centred care that is safe, timely, efficient, effective and equitable

(continued)

Table 42.2 (continued)

Domain	Competency	Competencies
Personal and professional development	Demonstrate the qualities required to sustain lifelong personal and professional growth	Develop the ability to use self-awareness of knowledge, skills and emotional limitations to engage in appropriate help-seeking behaviours
		Demonstrate healthy coping mechanisms to respond to stress
		Manage conflict between personal and professional responsibilities
		Practice flexibility and maturity in adjusting to change with the capacity to alter one's behaviour
		Demonstrate trustworthiness that makes colleagues feel secure when one is responsible for the care of patients
		Provide leadership skills that enhance team functioning, the learning environment and/or the health-care delivery system
		Demonstrate self-confidence that puts patients, families and members of the health-care team at ease
		Recognize that ambiguity is part of clinical health care and respond by utilizing appropriate resources in dealing with uncertainty

42.3.3 GMC's Tomorrow Doctors

The General Medical Council, responsible for UK medical education at a national level, published the first version of the outcomes document for undergraduate medical education in 1993 as 'Tomorrow's Doctors', derived from the new GMC statement of good medical practice. Table 42.3 shows a condensed version of this framework in its 2015 edition. It is arranged in three sections (scholar and scientist, practitioner and professional) with an overall statement of competence in each section and a series of outcomes (competencies). The full document includes beneath each bulleted competency a series of 3–10 sub-competencies, adding up to 106 in total (General Medical Council 2015a) and complies with the EU directive 2005/36/EC on recognition of professional qualifications (The European Parliament and the Council of the European Union 2005). While the competency framework constitutes the entrance requirements for clinical training in what the UK calls the 2-year *Foundation Programme*, GMC has published a separate document to list the competencies of *provisionally registered trainee doctors* with a licence to practice, categorized in eight sections (good clinical care, maintaining good medical practice,

Table 42.3 The outcomes for medical graduates of UK's General Medical Council

Outcomes	Competencies
Overall outcome	Medical students are tomorrow's doctors. In accordance with good medical practice, graduates will make the care of patients their first concern, applying their knowledge and skills in a competent and ethical manner and using their ability to provide leadership and to analyse complex and uncertain situations
The doctor as a scholar and a scientist	The graduate will be able to apply to medical practice biomedical scientific principles, method and knowledge relating to anatomy, biochemistry, cell biology, genetics, immunology, microbiology, molecular biology, nutrition, pathology, pharmacology and physiology
	Apply psychological principles, method and knowledge to medical practice
	Apply social science principles, method and knowledge to medical practice
	Apply to medical practice the principles, method and knowledge of population health and the improvement of health and health care
	Apply scientific method and approaches to medical research
The doctor as a practitioner	The graduate will be able to carry out a consultation with a patient
	Diagnose and manage clinical presentations
	Communicate effectively with patients and colleagues in a medical context
	Provide immediate care in medical emergencies
	Prescribe drugs safely, effectively and economically
	Carry out practical procedures safely and effectively
	Use information effectively in a medical context
The doctor as a professional	The graduate will be able to behave according to ethical and legal principles
	Reflect, learn and teach others
	Learn and work effectively within a multi-professional team
	Protect patients and improve care

teaching and training, appraising and assessing, relationships with patients, working with colleagues, probity, health, and 15 core clinical and procedural skills for provisionally registered doctors) (General Medical Council 2015b).

42.4 Controversies Around CBME

The competency frameworks have had, and continue to have, a huge impact on medical training worldwide. The frameworks of the three countries have been imported in many other countries. Particularly the CanMEDS framework has been very popular. For example, the Netherlands, as one of the first countries to quickly adopt it (Bleker et al. 2004), now shows a complete vocabulary of CanMEDS roles throughout all of undergraduate and postgraduate clinical training.

Yet, despite immediate enthusiasm among educators and regulators in so many countries, and the apparent face validity of competency descriptions, there has been persistent criticism around competencies, from the very beginning of the introduction of CBME and still ongoing (Brightwell and Grant 2013; Brooks 2009; Glass 2014; Grant 1999; W. Leung 2002; Malone and Supri 2010; Talbot 2004). How can we understand this opposition? Basically, the controversies evolve around conceptual and ideological issues, around assessment issues and around practical issues (Norman et al. 2014; Touchie and Ten Cate 2016).

42.4.1 Conceptual and Ideological Issues

One conceptual issue is the analytic nature of competency frameworks in general. This has been well described a few years ago (Pangaro and Ten Cate 2013). Outcome-oriented frameworks generally have an analytic nature. They start with a general set of abstract domains of interest (knowledge, skill, attitude) or a profile of what a graduate of education should look like, defined as a set of qualities. These aspects, intrinsic to the concept of the competence, are then simply unpacked or taken apart rather than derived from empirical observation. Next, each of these competencies is defined on a more detailed level, as they are usually considered too general for teaching and assessment purposes. For example, one of the four 'key' competencies of the CanMEDS 2005 manager role is 'physicians are able to allocate finite health-care resources appropriately'. One of its subordinate 13 'enabling' competencies is 'physicians are able to recognize the importance of just allocation of health-care resources, balancing effectiveness, efficiency and access with optimal patient care' (Frank 2005). The strength in this approach is that it aims at a comprehensive description of what we expect a physician to be. But the difficulty of highly analytic frameworks is that they lead to long and detailed lists of elaborate objectives that tend to lose clarity. Frameworks are abstractions of the real world that need to be remembered and applied by those who use them. Many people can remember a set of six (ACGME) or seven (CanMEDS) units. More elaborated subframeworks with dozens of units are usually not remembered. This results in documents that are not used, but end in a drawer, or if used, only at times or programme accreditation processes, not for the sake of training.

Next, critics have stressed the reductionist effect of using competency frameworks (Touchie and Ten Cate 2016). Grant argues that 'Behavioural objectives, or competences, can never describe complex human behaviour. The sum of what professionals do is far greater than any of the parts that can be described in competence terms' (Grant 1999). Brooks goes on to say that 'medicine is fundamentally a moral pursuit. At its heart is the physician-patient relationship, a relationship between two people. The atomistic and action focused concept of competency does not embody this view of medicine' (Brooks 2009). Hodges comments on the CBME movement as a shift from a 'tea-steeped' doctor trained in a time-based programme to a factory-produced i-Doc, resulting from a competency-based programme (Hodges 2010).

The first metaphor reflects the perspective of training doctors by just immersing them in a clinical context for a specified time, as a teabag in hot water; the opposite metaphor reflects the factory-made physician, by just putting the all competency parts together. In a recent book called *The Question of Competence*, Leung and colleagues explain how the 'competent mind' of the physician also includes qualities as situation awareness, metacognition, attentive automaticity and shared or distributed cognition in collaborative work, not easily captured in measurable competencies (Leung et al. 2012).

Most of the conceptual criticism may be summarized as acting against the analytical approach to physician competence, with the desire to train and assess (just) its detailed component parts, while ignoring the synthetic or holistic concept of the doctor as a whole (Touchie and Ten Cate 2016).

42.4.2 Assessment Issues

Evaluation of learners in the workplace is notoriously difficult from a psychometric point of view. It relies on subjective impressions of medical professionals, often not particularly trained in assessment and on test circumstances that cannot be standardized. Medical competence is in part context dependent, and the purpose of the assessment is typically not to know how trainees have acted in the past, but to predict how they will act in the near future (Ten Cate et al. 2015). Known difficulties include rater leniency bias or generosity error, halo effects, restriction of range, poor discrimination between trainees, lack of documentation of deficits, low intra- and inter-rater and cross-occasion consistency (Albanese 2000; Govaerts et al. 2007), idiosyncratic limitations of raters when categorizing trainees (Gingerich et al. 2011) and a general overestimation of trainees. In a systematic literature review, Lurie and colleagues found no instruments that can validly assess the ACGME competencies (Lurie et al. 2009), and in a later commentary they conclude that 'although competencies may prove useful in defining an overall social mission for organizations, such competencies should not be mistaken for measurable and distinct attributes that people can demonstrate in the context of their actual work' (Lurie et al. 2011). With the increased emphasis on accountability for the outcome of training, programme directors and individual educators collect much more data on clinical trainees than before, but are increasingly not at ease with the validity of such assessment of competencies. Brooks comments that 'the competency model—which tends to be top-down and prescriptive—does not provide the framework for objective educational assessment that it claims to provide… I, like all other practicing physicians, know other physicians whom I wouldn't let near me or my family members, regardless of the number of pieces of paper they might sport. Conversely, I know a number of physicians who are superior to me in my chosen field, despite the fact that they lack the subspecialty certification that I have' (Brooks 2009). Clinical Competency

Committees that ACGME demands for postgraduate programmes may improve the validity of assessment decisions about trainees, but their practice is not yet optimal (Hauer et al. 2015).

42.4.3 Practical Issues

Brook's comment resonates with others who experience the practice of competency-based training as checking boxes on checklists rather than assessing the outcome of training as the preparation for practice (Glass 2014; Talbot 2004). CBME is often felt bureaucratic and burdensome, requiring extensive written materials with forms and checklists, 'devaluing the role of educators into that of form-filling bureaucrats' (Malone and Supri 2010). The fear is also that CMBE limits broad medical curricula to knowledge and skills that prepare for measurable competencies and that educators are forced to 'teach to the test' (Malone and Supri 2010). Others have commented on the focus on minimum standards, on the rationale to predominantly serve regulators rather than students and on the implicit assumption that CBME will reduce the length of training (Brightwell and Grant 2013).

Another practical issue, not often mentioned in the literature yet, but essential for CBME, is the organization of time-flexible programmes. This poses immediate and immense logistical difficulties, as training and service are intertwined in postgraduate medical education. Trainees must be trained until they are ready for unsupervised medical practice and then move on to a next step or rotation. However, resident trainees provide much of health-care service, and many hospitals depend on them. A time-flexible training programme thus means time-flexible employment of trainees, and hospital managers are not ready to think in this direction. Programmes that implement CBME seriously must reconcile educational and service demands at a practical level.

42.5 Recent Developments

Faced with the fact that the existing CBME models do not (yet) succeed in attaining the aims set in the 1990s, responsible organizations and educational scholars have sought ways to improve the approaches. In 2012, the AGGME announced a next generation of rules for accreditation (Nasca et al. 2012). In 2015, the 'CanMEDS 2015' model presented improvements and additions to the existing Canadian framework (Frank et al. 2014) and in the same years the GMC resented the new objectives of physician training (General Medical Council 2015a). But apart from these maturations of the frameworks, new concepts were introduced. Two of them merit a discussion in this chapter, *milestones* and *entrustable professional activities* (Englander and Carraccio 2014; Hernandez 2015; Sklar 2015; Teherani and Chen 2014).

42.5.1 Milestones

The ACGME competency framework has always been inspired by one particular developmental model. The five Dreyfus stages of development of skill, including Novice, Advanced beginner, Competent, Proficient, and Expert, were first described in 1986 (Dreyfus and Dreyfus 1986), and led ACGME to consult the Dreyfus experts when designing their competency framework (Batalden et al. 2002). But only several years later it was suggested to actually superimpose the five Dreyfus developmental stages on the framework (Carraccio et al. 2008).

Milestones were adopted by ACGME to facilitate the assessment of learners in the workplace (Nasca et al. 2012). They are concrete behavioural descriptions aligned with developmental steps in separate domains of competence, to assist clinicians in the assessment of medical trainees to establish a 5-step logical trajectory of professional development within competencies (Touchie and Ten Cate 2016). Developed as benchmarks for effective assessment, ACGME milestones were written for all US postgraduate medical disciplines and published in the Journal of Graduate Medical Education in March 2013 and March 2014. They are short descriptions of typical resident behaviour at sequential stages of training, following matriculation into a specialty, targeted to an advanced level for graduation to practice (Level 4, proficient), and ending at an aspirational level to be achieved only by exceptional residents (Level 5, expert) (Swing et al. 2013). Specialty milestones are the framework for annual reports on resident progress.

Figure 42.1 shows one example. It is one of the 21 milestone-sets of the paediatric competencies (Carraccio et al. 2013). In 2014, all specialities have described milestones for their programmes (Swing et al. 2013), and every US resident must now be regularly evaluated against all competencies of the speciality using these milestones.

Competency: Demonstrate Humanism, Compassion, Integrity, and Respect for Others; Based on the Characteristics of an Empathetic Practitioner				
Level 1	Level 2	Level 3	Level 4	Level 5
Sees the patients in a "we versus they" framework and is detached and not sensitive to the human needs of the patient and family	Demonstrates compassion for patients in selected situations (eg, tragic circumstances, such as unexpected death), but has a pattern of conduct that demonstrates a lack of sensitivity to many of the needs of others	Demonstrates consistent understanding of patient and family expressed needs and a desire to meet those needs on a regular basis; is responsive in demonstrating kindness and compassion	Is altruistic and goes beyond responding to expressed needs of patients and families; anticipates the human needs of patients and families and works to meet those needs as part of his skills in daily practice	Is a proactive advocate on behalf of individual patients, families, and groups of children in need

Fig. 42.1 Example of ACGME milestone descriptions with one of the 21 competencies of paediatric training (Carraccio et al. 2013)

The Royal College of Physicians and Surgeons of Canada has followed this course by introducing milestones in the CanMEDS 2015 version. Here, milestones are defined as 'descriptions of the abilities expected of a trainee or physician at a defined stage of professional development' of each of the 'enabling competencies' under the seven CanMEDS competency roles, to guide learners and educators in determining whether learners are 'on track' (Frank et al. 2014). Whereas all ACGME milestones have been designed by specialty associations, the RCPSC milestones are general and described in one document to be applicable across all specialties. Unlike the US milestones, the CanMEDS milestones are bound to seven predefined stages of the educational continuum (medical school fundamentals, early clinical activity, transition to discipline, foundations of discipline, core of discipline, transition to practice and continuing professional development).

42.5.2 Entrustable Professional Activities

The concept of Entrustable Professional Activities (EPAs) was introduced in 2005 (Ten Cate 2005). After a publication in *Academic Medicine* in 2007 (Ten Cate and Scheele 2007), it has attracted substantial attention among postgraduate programmes in the USA, Canada and other countries. In July 2015 this paper was cited over 300 times according to Google Scholar and a PubMed search shows that, since 2007, 125 articles have appeared with EPA terminology in their title or abstract, 119 of which in 2013 or later.

A most recent elaborate description of the concept and how to use it in workplace training and assessment can be found in a Guide 99 of the Association for Medical Education in Europe (Ten Cate et al. 2015), from which document the excerpts below are derived.

An Entrustable Professional Activity can be defined as a unit of professional practice that can be fully entrusted to a trainee, as soon as he or she has demonstrated the necessary competence to execute this activity unsupervised. It was developed to operationalize competency-based postgraduate medical education.

Much of the work in health care can be captured by tasks or responsibilities that must be entrusted to individuals. EPAs usually require a practitioner to possess and integrate multiple competencies from several domains, such as content expertise, skills in collaboration, communication, management, etc. Conversely, each domain of competence is relevant to many different activities. Combining domains of competence and EPAs in a matrix reveals which competencies a trainee must achieve before being trusted to perform an EPA (Ten Cate 2013, 2014a). The matrix in Fig. 42.2 provides specifications that are helpful for assessment and feedback, for individual development and to ground entrustment decisions.

EPAs have now been identified for many graduate medical education programmes including obstetrics–gynaecology, paediatrics, internal medicine, family medicine, psychiatry, haematology and oncology and pulmonary and critical care

	EPA1	EPA2	EPA3	EPA4	EPA5	EPA6
Competency 1	●		●	●	●	
Competency 2		●	●	●		
Competency 3		●	●	●		●
Competency 4	●	●				
Competency 5	●	●	●		●	●
Competency 6			●			
Competency 7		●	●			●

Fig. 42.2 EPA-competency matrix

(Boyce et al. 2011; Caverzagie et al. 2015; Fessler et al. 2014; Gilhooly et al. 2014; Scheele et al. 2013; Schultz et al. 2015; Shaughnessy et al. 2013).

An example of an EPA is *conducting an uncomplicated delivery.* This activity, performed by family physicians and obstetrics–gynaecology specialists, needs to be entrusted to a trainee at some point in their training, as the trainee eventually will need to conduct it without supervision. It requires specific knowledge, skills and behaviours; proficiency is acquired through training; it is directly observable and reflects competencies. As this activity particularly reflects the CanMEDS roles of medical expert, communicator and collaborator, it exemplifies how EPAs integrate competencies. Other examples of EPAs from the cited literatures are providing preoperative assessment, managing care of patients with acute common diseases across multiple care settings, providing palliative care, managing common gastrointestinal infections in non-immunosuppressed and immune-compromised populations, conducting a family education session for schizophrenia, conducting a risk assessment, serving as the primary admitting paediatrician for previously well children suffering from common acute problems, pharmacological management of an anxiety disorder, providing end-of-life care for older adults and office-based counselling in developmental and behavioural paediatrics.

A comprehensive set of EPAs should cover the core of a profession. Linked to the EPA construct is *entrustment decision-making* (Ten Cate et al. 2016). This process serves to acknowledge ability, to provide permission to act unsupervised and to enact duties in health-care practice. True competency-based medical education grants certification as soon as competence is adequately demonstrated. EPAs allow for making entrustment decisions for separate units of professional practice, resulting in a gradual, legitimate participation in professional practice (Lave and Wenger 1991) rather than on the last day of training. It transforms the traditional assessment of trainees into entrustment decisions for professional tasks (Ten Cate et al. 2015). As trust increases, the level of supervision can decrease. A model of five levels of

1. be present and observe, but not permitted to perform the EPA
2. permitted to act under direct, pro-active supervision, present in the room
3. permitted to act under indirect, re-active supervision, readily available to enter the room
4. permitted to act without qualified supervision in the vicinity; with distant supervision, and basically acting unsupervised
5. permitted to supervise junior trainees regarding the EPA

Fig. 42.3 Five levels of supervision and permission

supervision, entrustment and permission has been proposed for postgraduate training, shown in Fig. 42.3 (Ten Cate 2013; Ten Cate and Scheele 2007; Ten Cate et al. 2010).

The use of EPAs in competency-based training has been considered a practical and conceptual solution to the rather theoretical approach to postgraduate competencies thus far (Englander and Carraccio 2014; Gilhooly et al. 2014). While developed for postgraduate training, EPAs are now being introduced in most US undergraduate medical programmes and in some other countries (Chen et al. 2015; Englander et al. 2014).

42.5.3 Combining Milestones, EPAs and Assessment Technology

While the implementation of milestones and EPAs, on top of competencies, seems another burden for programmes and individual teachers (Norman et al. 2014), some authors have suggested to combine both. Eric Warm, programme director of the University of Cincinnati Internal Medicine residency training, has simply equated the five milestone levels of competencies (Fig. 42.1), with the five supervision levels of EPAs (Fig. 42.3). Faced with the need to regularly report on milestones for all residents, he asks clinicians to estimate the trainees' readiness for direct supervision, indirect supervision or unsupervised practice. A decision to trust a trainee to work alone is easier than to score on a scale of milestones and likely more reliable (Crossley et al. 2011; George et al. 2014; Weller et al. 2014). Warm reported successes in organizing regular evaluations of all IM residents by scoring on an entrustment scale, assuming similarity with milestones scales. This yielded almost 200.000 data points over a 2-year period, processed electronically to show how 100+ residents gradually progress in their competence over time (Warm et al. 2013, 2014).

Clearly, competency-based medical education requires observation and feedback (Gruppen 2015). Reporting these observations can be hugely enhanced by using

mobile technology and electronic portfolios (George et al. 2014; Mehta et al. 2013; Ten Cate et al. 2015). If observations can be recorded on a smartphone and instantly sent to an electronic portfolio, there is no need for paper work (Ten Cate et al. 2015).

42.6 Conclusions

The quest for competence in health professionals (Hodges and Lingard 2012) and the pursuit of competence during training have occupied the minds of professionals and medical educators for ages (Flexner 1910; Irby et al. 2010; Lindeboom 1968; Ten Cate 2014a, b, c; Walsh et al. 2015). Yet only in the past decades competency-based medical education has come truly central to medical training. Designing education that only leads to graduating fully competent medical practitioners is an aim that may never be reached. CBME is likely not a state that is to be reached satisfactorily at a certain point in time. It is more likely, and probably more productive, to think of it as a journey that will not end, but that will incrementally improve training.

We will not be able to predict what the discussion and development of CBME will be 20 or even 10 years from now. One possible advance however may be the thinking of competency-based medical *practice* rather that competency-based medical education alone (Touchie and Ten Cate 2016). At the end of the day, our concern is the quality of medical care by practitioners, not learners.

In a not unlikely near future, medical graduates may be certified for separate EPAs within a CBME programme. EPAs allow for flexibility and individualization. Not every trainee needs to follow a similar path, and graduates, from whichever undergraduate of postgraduate programme, do not need to be identical. In the future, medical professionals may rather be defined by their portfolio of certified EPAs than by a single registration as physician or medical specialist. Using EPAs for this purpose may allow for a much more dynamic maintenance of competence, as EPA certifications may be gained but may also be lost, if doctors do not practice them for a long time (Mehta et al. 2013; Ten Cate et al. 2015; Touchie and Ten Cate 2016). Learning and training may not just be confined to the formal enrolment in an educational programme, but may be a matter of a true lifelong pursuit of valid competence, responding to whatever needs professionals face to serve the public at any moment in a professional lifetime.

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Chapter 43
Green Skills as the Agenda for the Competence Movement in Vocational and Professional Education

Margarita Pavlova

43.1 Introduction

The importance of transitions towards greener economies has been recognised by different regions and countries, e.g. EU (the European Commission 2010) and China (The Central People's Government of the People's Republic of China 2011). Many governments set up ambitious targets to address issues of climate change and low-carbon economies. Although there are many challenges and barriers hindering green growth, greening of economies is viewed as a forward-thinking agenda. In Asia and the Pacific region, for example, the development of a greener economy that recognises the 'important interlinkages between the environmental resource base, economic systems and social development' (UN 2012) would arguably encourage investment and capacity development in areas such as renewable energy resources, green manufacturing sectors, urbanisation, food security, sustainable agricultural practices and retention of biodiversity. This alternative growth model that goes 'beyond GDP' (European Commission 2009; European Commission SWD 2013) has been on the agenda for many years, and one indication of this process is the development of the Global Sustainable Competitiveness Index (GSCI) that puts forward a different way of measuring economic development – compared to the traditional Global Competitiveness Index (GCI). Structural economic changes that are required to achieve greening of economies, for industry in particular, are mainly driven by the current and future shortage of resources and their increasing price, technological development and innovation, new markets and changes in industrial practices and consumer demands. However, government policies and

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regulations are also important for stimulating structural change. They can be driven by issues of climate change, environmental degradation and health as well as other aspects of personal and social well-being. China, for example, aims to create a circular economy as one objective of their current five-year plan (The Central People's Government of the People's Republic of China 2011). Reduction, reuse and recycling at every stage of production and consumption are promoted. The Economic and Social Survey of Asia and the Pacific (ESCAP) (UN 2013) concludes that government policies directed towards strengthening *social and environmental pillars* of sustainable development could serve as 'the solution to improving the quality of growth in the region' (ibid, p. 62). OECD (2012) argued that:

> Relying on the market to identify skills gaps and develop solutions to them is causing delays in the transition to a green economy. Governments at national and local levels should play a more active role in preparing the labour market and providing the skills needed to meet greener economic needs (p.19).

These economic changes caused by green restructuring should be supported by human resource development, which has a significant impact on skills and competencies through training. Skills demand associated with these changes is a global challenge. Vocational and professional education should respond to the low-carbon transitions by recognising that the whole economy is affected. High targets set up by the EU, in terms of reducing greenhouse gas emissions and energy use and increasing the share of renewable energy sources in final energy consumption, have a significant effect on skills demand (CEDEFOP 2013). The final report on the UN Decade of Education for Sustainable Development (UNESCO 2014) identified actions taken around the world to meet this demand. These include technical, vocational education and training (TVET) teacher training in China, collaboration of several stakeholders on curriculum design in Mauritius, the introduction of sustainable development (SD) into vocational qualifications and packages in Finland and Australia and the integration of education for SD (ESD) as a whole-school approach in the Netherlands. The understanding of TVET's contribution to sustainable development has been broadened, and TVET has started an orientation towards ESD inclusion.

This chapter examines approaches towards the formulation of green skills and their place within a competence-based vocational and professional education. 'Green' skills are interpreted as technical skills, knowledge, values and attitudes necessary for workers in the transition towards an economy that has a reduced negative impact on the environment (NCVER 2013). A focus on green restructuring and skills is considered as one of the fast-developing policy fields. Academic research in the area is also emerging that highlights conceptual and methodological issues associated with training for greening skills (e.g. Larsen et al. 2014). Greening of the vocational and professional education curriculum is a global issue. Although this chapter examines issues associated with greening vocational and professional education that have a general application, examples are contextualised within the Asia-Pacific region (APR). It also evaluates the greening of vocational and professional education in several Asian countries and argues that state-funded green innovation

initiatives could play an important role in transitioning towards a greener economy alongside the inclusion of green skills into a competence-based vocational and professional education.

43.2 Green Skills

Due to economic restructuring with the purpose of attaining a cleaner, more climate-resilient efficient economy that preserves environmental sustainability and provides decent work conditions, the importance of addressing green skills development is critical.

The OECD report in 2011, for example, concludes that human capital development should be an integral part of green growth strategies. This transition

> will have a significant impact on the skills needs, with increased demand for skilled workforce in growing eco-industries, up-skilling of workers across all sectors, and re-skilling of workers in sectors vulnerable to restructuring (European Commission 2014, p. 5)

Green growth requires the development of *new skills* for both new jobs in green sectors as well as existing jobs that are changing to be more environmentally friendly. Job creation in renewable energy, retrofitting of existing buildings, mass transportation, wastewater management and environmental conservation is in progress in many countries with multiple initiatives in place to train for greener jobs. There are several approaches towards the classification of green skills.

The CEDEFOP (2010) study identifies specialised and generic green skills and the necessity of topping-up existing skills. The study also analyses their relative influence on the greening of economies along with the volume of workforce affected. Topping-up skills and adding generic green skills could be addressed through existing skills programmes and mechanisms. However, training that would enable people to develop specialised green skills may require the introduction of new programmes.

The findings suggest that the majority of skills development responses associated with moving towards low-carbon economies are related to upskilling or adding to existing core skills ('topping-up') to enable a person to meet the requirements of a new occupation. For example, after upskilling their knowledge of energy sources, their ability to integrate energy systems and project management, industry electricians or energy technologists could have new occupations as managers in renewable energy. After obtaining new competencies in technical training, combined with knowledge of administrative procedures and entrepreneurial skills, a plumber or electric and heating installer could become a solar-energy entrepreneur or an installations project designer.

Generic green skills is the second most important skill in terms of contributing to the greening of economies and affecting the proportion of the workforce. Even though specialised green skills affect less people, they play an important role in green economic restructuring.

The distinction between generic skills and specific green skills follows the approach that is widely accepted in the literature and which differentiates between generic/key/core competencies and task-oriented competencies that are required for a specific occupation (e.g. Pellegrino and Hilton 2012; Binkley et al. 2012; European Commission 2007; Rychen and Salganik 2003; Curtis and McKenzie 2001; Mayer 1992). Both types of competencies are utilised in a specific context and require knowledge, skills and attitudes (beliefs, dispositions and values). However, there is a terminological debate with respect to the use of these terms. The term 'skills', when used in a broad sense, is very close to the notion of competencies – an ability to act appropriately in a given context. However, in a narrow sense, skills also refers to technical capacity. Different frameworks could describe 'skill' as an aspect of 'competency' or as a distinct category (e.g. European Commission 2007, 2008). In this chapter, competencies and skills are used interchangeably.

Key competencies have been defined by the OECD (2013) as:

> "general" competencies in the sense of being relevant to all members of the working population and across all fields of economic and social activity (p. 95).

Although classifications of key competencies vary, there are considerable linkages between different frameworks that facilitate the identification of four broad groups of competencies. They include cognitive competencies (communication, information processing, problem-solving, learning, mathematics), interpersonal skills (team work, cultural sensitivity, working with others, relating to customers, negotiating, participating in projects and tasks), intrapersonal competencies (self-regulation, management, creativity/entrepreneurship) and technological skills (usually related to the use of ICT) (OECD 2013).

43.2.1 Key/Generic Green Skills

Key green skills (also referred to as generic green skills) are required in almost any occupation in order to understand and appreciate the issues and demands of greening economies. These generic green skills facilitate the preparation of the future workforce to understand issues of green growth (including environmental, social and economic aspects) and to interpret environmental legislation, thereby increasing energy and resource efficiency which in turn enables the processes necessary for transitioning to a greener economy. At least two approaches for the identification of generic green skills can be found in current research: the first is closely related to the notion of generic skills (e.g. ILO 2011) and the second is based on greening processes that are similar across sectors (e.g. Percapita Report 2010).

The first approach identifies the main core skills necessary for green jobs. Following the framework developed by OECD (2013), the author suggests classifying the generic green skills suggested by ILO (2011) as follows:

Cognitive Competencies

- Environmental awareness and a willingness to learn about sustainable development
- Systems and risk analysis skills to assess, interpret and understand both the need for change and the measures required
- Innovation skills to identify opportunities and create new strategies to respond to green challenges

Interpersonal Skills and Technological Skills

- Strategic and leadership skills to enable policymakers and business executives to set the right incentives and create conditions conducive to cleaner production, cleaner transportation, etc.
- Coordination, management and business skills to facilitate holistic and interdisciplinary approaches that encompass economic, social and ecological objectives
- Communication and negotiation skills to discuss conflicting interests in complex contexts
- Marketing skills to promote greener products and services
- Networking, IT and language skills to enable participation in global markets
- Consulting skills to advise consumers about green solutions and to spread the use of green technologies

Intrapersonal Competencies

- Adaptability and transferable skills to enable workers to learn and apply the new technologies and processes required to green their jobs
- Entrepreneurial skills to seize the opportunities of low-carbon technologies

Generic green skills identified in this first approach are similar to the key competencies/soft skills employers recognise as crucial for the modern workforce. In addition these skills relate to environmental awareness and the understanding of sustainable development issues. Although science, technology, engineering and mathematics (STEM) skills are not listed by the ILO, they could be added to the list of cognitive competencies as they are particularly relevant to the high-skills jobs. General STEM skills, such as a general understanding of the role of science, technology, engineering and mathematics – in terms of their contribution to the process of greening economies and societies – could be important for the greening of vocational and professional education (also emphasised by CEDEFOP 2010).

To achieve green restructuring, the whole economy should be implementing green practices. Therefore, although CEDEFOP (2010) differentiates between generic skills and generic green skills, this chapter argues that generic skills – enriched by green components (or 'enriched' by green generic skills) – can be formulated as one set of soft/green skills. Thus, greening is important for every workplace, and enhancing the implementation of just one set of generic skills would provide clear guidelines for vocational and professional education practitioners. These can be labelled 'enriched by green generic skills'.

The second approach, proposed by another study (Percapita Report 2010), suggests the following list of generic green skills (they are related to processes similar across different sectors):

- Quantification and monitoring (waste, energy, water)
- Management systems (waste, energy, water)
- Procurement and selection
- Material use and impact quantification
- Impact and use minimisation
- Impact assessment
- Risk management

These 'green processes generic skills' were collated based on the greening approaches utilised in Denmark, Germany, the UK and the USA (Percapita 2010). The study concludes that green skills implementation in those countries started as sector-specific skills, some of which become generic over time. This second set of generic green skills provides a *generic framework for occupation-specific green skills* development that should be included in programmes, because by topping-up skills, the environmental impact of particular work practices could be eliminated. Both types of generic green skills are important for competence-based learning, and they should be included in programmes to achieve the greening of vocational and professional education.

43.2.2 Topping-Up Skills

The notion of topping-up skills suggested by CEDEFOP (2010) should be enriched by the second way topping-up skills could occur – adding skills for tasks in existing occupations with environmentally friendly practices. The addition of these skills *does not lead to a different occupation* (e.g. a plumber, after upskilling in the use of water-saving products, recycling processes, becomes a plumber that uses more environmentally friendly products and processes). The processes of topping-up skills have been conducted and completed in several countries, including Australia where environmental content was introduced into national training packages. For example, an updated Electro-technology Training Package (UEE11) includes several competency standard units (CSU) that are related to green skills such as (i) participating in environmentally sustainable work practices, (ii) implementing and monitoring policies and procedures for environmentally sustainable electro-technology work practices and (iii) developing effective strategies for energy reduction in buildings.

Each CSU includes specific green competencies. The CSU, on *implementing and monitoring policies and procedures for environmentally sustainable electro-technology work practice*, for example, specifies the outcomes for the collection, interpretation and application of environmental management information, as well as the identification of environmental impacts and assessment of risks. It also consists

of monitoring (while implementing environmentally sustainable work policies and plans), as well as developing modifications as part of the review process (National Register on Vocational Education and Training). This particular CSU has the following three elements: prepare/plan, carry out and complete the implementation and monitoring of environmental and sustainable energy management policies and procedures. The second element includes performance criteria such as:

- Environmentally sustainable work practices to reduce/minimise waste and excessive energy use are implemented and monitored, in accordance with requirements and/or established procedures with input sought from specialists where possible.
- Implementation and monitoring of environmentally sustainable energy management policies and procedures are carried out, in accordance with the work schedule and requirements and/or established procedures.
- Essential knowledge and associated skills for the safe implementation and monitoring of environmental and sustainable energy management policies and procedures are applied to ensure completion in an agreed timeframe, and to quality standards with a minimum of waste according to requirements.

These top-ups of existing skills were included in training packages following close collaboration with industry and reflect an explicit orientation of vocational and professional education towards greening. The existing mechanisms for updating training packages were used.

43.2.3 Specialised Green Skills

Specialised green skills that relate to new green occupations are country specific. What may be seen in one country as 'topping-up existing skills' could be the development of new training programmes for newly established occupations in other countries (e.g. a recently established waste management training programme in Indonesia). Many international studies focus on the identification of industries that play a core role in the greening of economies. The majority of reports (e.g. Hardcastle 2009; ILO 2011; UNESCO-UNEP 2012; Australian Conservation Foundation and Australian Council of Trade Unions 2008) suggest that the key green industries are related to:

- Energy efficiency and renewable energy
- Green building and retrofitting
- Water resources, water management and ecosystem management
- Sustainable agriculture and biomaterials

The ILO (2011) report also includes transport. Therefore, the introduction of new technologies in these industries and the identification of competencies for training and establishing of training programmes based on those competencies are important steps towards achieving a greener economy.

Organisation-based education and training programmes based on competencies are currently viewed as the most effective way of organising vocational and professional education. It is argued that competencies should meet present industry requirements; therefore they could provide the best possible way to match training with the needs of economy. Competency-based education and training has been introduced in education and political discourses to establish closer links between education and the labour market (Grant et al. 1979). Subsequently however a diverse interpretation of competencies has been developed across different countries. In England, for example, competencies are directly related to performance, and relate to procedures of assessment and accreditation (Weigel et al. 2007). In Germany, competencies are designed on a higher level of abstraction – to increase the potential for transfer. They consist of five competence fields: action, subject, personal, social and methods or learning competence. In France, the emphasis is on the balance between personal and occupational development (ibid). Therefore, the treatment of personal qualities, attributes and attitudes is the main area in which frameworks differ.

Introduction of green competencies in vocational and professional education requires increased emphasis on personal qualities, attributes and attitudes as they are particularly important for achieving sustainable green practices at workplaces. A number of studies demonstrate that people are often aware of environmental issues and the importance of addressing them; however, they are not prepared to act on them (e.g. Maclean and Pavlova in press). Hence, attitudes and values should constitute an essential part of competence education. Development of green skills should be framed by values based on weak anthropocentric ethics as argued elsewhere (e.g. Pavlova 2009, 2013) and a broad understanding of environmental and social processes in the globalised world combined with an active personal position.

Therefore, two sets of core green competencies (‘enriched by green generic skills’ and ‘green processes generic skills’) and specific competencies (required both for green industries and for topping-up existing competencies in all industries) together with value-based approaches for competence development should be introduced in vocational and professional education programmes to make them greener.

43.3 Greening of Vocational and Professional Education

The processes of greening vocational and professional education are occurring more actively in a number of European countries as well as in Australia, Canada and the USA. The question is: to what extent are green competencies present in vocational and professional education programmes in Asia? The ILO Global Report (2011) concludes that in many developing countries, governments and formal vocational and professional education institutions have not yet responded to skill challenges associated with environmental issues and climate change.

> Training responses are often isolated and sporadic, and their impact on the greening of industries, and the economy as a whole remains limited (ILO 2011, p.142).

In particular, the report states that when countries do not have well-developed mechanisms to adjust to the changing needs of the labour market (education and training systems are less responsive), companies usually account for the biggest proportion of skill provision.

Often procedures for developing skills programmes within training systems are slow, and in developing countries NGOs play a key role in non-formal skills provision for green jobs. Mainstreaming environmental topics through all levels of compulsory education is viewed as an effective approach in creating general environmental awareness. At the university level, a wide range of subjects addressing environmental issues have been included in courses and programmes (ILO 2011).

The experiences of formal vocational and professional education analysed across several Asian countries demonstrate that governments do not address the greening of vocational and professional education in a systematic manner. However, the greening of vocational and professional education is underway, and the main reasons for that include:

- International training standards used by vocational training providers (VTPs) often include environmental protection issues (e.g. for marine training according to International Marine Organisation standards).
- Environmental legislations (e.g. emission control systems).
- Industry- and sector-specific rules and regulations (e.g. in training for the hospitality sector, hygiene in food preparation; security roles at a hotel includes environmental protection).
- New occupations (e.g. specialised green skills – eco-tourism is one of the subjects in a tour guide specialisation).
- VTP initiatives (e.g. introduction of a hybrid engine module into the curriculum, and setting up start-up teams to encourage technological innovations that address environmental concerns).
- Government initiatives (e.g. *The National Action Plan for Haritha Lanka programme* request that universities and technical colleges identify subject areas to incorporate issues of SD; governments of Malaysia and the Philippines develop special approaches for greening skills, in addition the development of modules, subjects and units for both specific and generic green skills initiated by the ministries that vocational and professional education providers should include in their programmes or can use when developing programmes).

Based on a number of studies (Pavlova 2007, 2014) and analysis of existing practices, a model for greening formal vocational and professional education at the institutional level is proposed in Fig. 43.1. Different components of this model have been observed in current practices; however, only a few institutions used an approach where several components were present.

<table>
<tr><td colspan="4">Attitude change</td></tr>
<tr><td colspan="3">Teaching and learning</td><td>Green campus and extra-curricula activities</td></tr>
<tr><td colspan="2">Content</td><td>Pedagogy</td><td></td></tr>
<tr><td>Generic green skills (two types)</td><td>Specific green skills</td><td>E.g. Learner-oriented including workplace learning</td><td>Links with community</td></tr>
</table>

Fig. 43.1 Model for greening formal vocational and professional education: an institutional level

Both generic and specific green skills/competencies are the part of the model. Some examples of existing practices from Asian countries are presented below to illustrate the proposed approach for green skills/competencies inclusion.

43.3.1 Generic Green Skills

Governments have started addressing the issues of generic green skills. The Ministry of Education and Training (MOET) in Vietnam, through a specific strategy responding to climate change (supported by the EU), has initiated the process of introducing a 30-hour subject on climate change. Two subjects on environmental protection, one for agriculture (30 hrs) and one for industry (30 hrs), became compulsory for secondary professional schools. That initiative affects around 650,000 students at the intermediate vocational and professional education levels. Nineteen thousand teachers require training. In Sri Lanka some newly developed National Vocational Qualification (NVQ) packages include basic concepts of pollution and environmental concerns. Career guidance courses developed for technical colleges also have an environmental module.

For many vocational training providers (VTPs), modules on occupational health and safety – although specific for particular occupations – have been viewed as units where some generic green skills are addressed. Industrial safety units contain some content on environmental awareness, hygiene and safety.

At the institutional level, VTPs understand the importance of including environmental awareness into their training programmes; however, a majority do not have the capacity to do this. For example, Sri Lanka Institute of Tourism and Hotel Management identified a need to include a generic environmental module in one of their training programmes; however, they did not have the capacity to do this and invited university lecturers to deliver it. 'Environmental studies, Global Trends and Current Issues' was delivered for the first time in 2012.

43.3.2 Specific Green Skills

Training towards international standards requires VTPs to address environmental concerns. International standard for marine specialisations is one example. Teaching syllabuses have a number of courses directly related to environmental protection, for example, water and environmental engineering training. Many countries in the region use these IMO (International Marine Organisation) standards in their training programmes in marine engineering and navigation. Environmental issues are included in them.

Environmental legislations have stimulated the inclusion of environmental issues into training. Industry associations conduct training courses on environmental regulations and skills development in managing the natural environment, waste recycling and solid waste treatment. They also facilitated a dialogue between the government and industry on policy adjustments to match internal regulations, national laws and international regulations to enable industry to export products.

In Vietnam environment legislation is rather strong within the railway system, so environmental issues are integrated into several modules at the Vietnam Railway Vocational College (e.g. waste management on trains for assistant service staff). The college conducts short courses on energy saving and environmental protection, including environmental regulations for workers and managers of the railway. When they do not have a particular expertise, they invite experts from ASEAN. In 2012 the college developed a new subject, 'transportation environment' (that complies with ISO 14000, environmental regulations), and it was submitted for an approval.

In Sri Lanka a number of vocational and professional education providers referred to training for car emission testing, aimed at reducing air pollution as specified in government regulations by the Ministry of Environment in 2008. As a result, a special module on emission control system was developed and technicians have been trained. The Ministry of Environment provided equipment for training for emission testing as well as the guidelines. Another example is training for refrigerant recovery and recycling. The Ministry of Environment has conducted three-day training sessions for vocational and professional education instructors. The Ministry of Environment representatives visited institutes to support the introduction of refrigerant recovery and recycling and gave instructions and lectures to staff. The Tertiary and Vocational Education Commission (TVEC), Sri Lanka, claimed that around 400 private training providers received grants to purchase refrigerant recovery equipment.

Consumer demands also stimulate the introduction of specific green skills. Tran Hyng Dao Vocational College identified a need for eco-food for a growing tourist industry in Vietnam as well as for export opportunities. The college planned to train farmers in 'clean production', increase their productivity and develop their abilities to export 'clean products' to other countries. They were planning to establish three-month training courses under the rural training policy strategy and were inviting experts from Hanoi University of Agriculture and Bristol Research Institute of Agriculture to discuss curriculum development and required technology. The first

intake was in 2015. The training programme also included: waste processing and the use of biogas to support college needs (they established a company within the college for biogas production).

New training programmes have been introduced, such as a municipal solid waste operation assistant training package (level 2 NVQ certificate) in Sri Lanka. The next step is to develop 'municipal solid waste operators' (supervisory capacity) programme at level 4. In addition to new training programmes, new green courses have been introduced in existing programmes. The Bac Thang Long Economic-Technical College (BTL), Vietnam, has recently introduced three subjects in the electricity and electronics majors. Two are compulsory for a number of programmes and are designed to propose and implement solutions for energy management, energy saving and the reduction of production costs. The third subject, 'Use of Renewable Energy Sources', is an elective (100 hours), which highlights the practical significance of renewable energy sources to protect the environment and promote sustainable development. It was introduced in 2013.

Several institutes in Sri Lanka introduced programmes on hybrid vehicles. The Ministry of Youth Affairs and Skills Development supported the process through the production and purchase of training materials, including a hybrid simulator. Plans were also related to the introduction of solar cell technology into the training programmes through a six-month solar power course in electric engineering training. However, the institutes need to identify solar power companies in order to send their students on industry placements.

43.3.3 Pedagogy

International research on innovative pedagogy identified several categories of practices that facilitate effective teaching and learning in vocational and professional education. Although they have not been specifically aimed at exploring pedagogy required for green skills/competencies learning, they identified practices that can be applied for a greening context such as closer engagement in work-based learning; new technology that facilitates learning; networks, centres of excellence and resource banks; and networks in professional practice (Hillier 2009). In addition, using authentic learning tasks as the basis for learning, encouraging peer learning, applying e-learning technologies, using the workplace as the primary site for learning and skill development, personalising learning and devolving support for teaching and learning so that it is close to the practitioner (Figgis 2009) are other trends in contemporary practice that deserve further consideration for green skill pedagogy. A call for a transformative pedagogy (Wals and Corcoran 2012; Pavlova 2013; Lotz-Sisitka et al. 2015) that can help to address current challenges and focus on sustainability transitions is equally valid for vocational and professional education. This pedagogy prepares students for addressing change, complexity and the uncertainty of the world and the workplace.

In many developing countries, however, teaching and learning in vocational and professional education follows traditional teacher-centred, demonstration-based learning. However, vocational and professional education institutions in Asia are trying to develop new approaches. The Bac Thang Long Economic-Technical College (BTL), Vietnam, employs a variety of teaching methods such as student-centred learning, group work and brainstorming which are less traditional approaches in vocational and professional education settings. Together with demonstrations and workplace learning, these approaches engage students in integrating theory and practice with a focus on student-centred learning. Typical features of teaching and learning at the college are a mix of school-based learning, workplace-learning and extracurricular activities, such as the managers' club, cultural performance club, sports club and English club. This combination is aimed at the development of knowledge, skills and attitudes of students.

In 2011, the National Vocational Training Institute (NVTI), Sri Lanka, established an environmental committee. It is intended to support the general well-being of students and their health, to develop a particular culture among students, to talk about changes in natural and built environment and to advertise news and involve students in the landscaping of their campus. In 2011, they also introduced a new training course in landscaping, so greening of the NVTI campus will be a practical application of students' skills and knowledge.

Don Bosco Technical Centre, Negombo, Sri Lanka, uses a holistic approach towards greening. Their approach includes the use of alternative energy sources, energy conservation, waste management, greening of campus and aid to local communities. They are producing biogas through the piggery – established on their campus where food waste from the centre's canteen for 400 students is utilised. The biogas is used for cooking at their canteen and for running an energy generator, with water as a side product. They are focusing on energy conservation, recycling scrap metal, reusing timber producing racks and decorations. In terms of teaching, they are trying to include environmental issues in theoretical training, as they do not have equipment to practice it. This centre also needs funding for teacher training to deal with waste water and electricity efficiency. The centre experimented with building their own solar cells, and now they need capital income to start the LED assembly. They are planning to support the local community by selling LEDs cheaply at the local market. For Don Bosco, the holistic development of students is the main aim, and vocational and professional education training provides the means.

43.3.4 Green Campus and Extracurricular Activities

Many colleges in Vietnam organise activities such as 'Green and beautiful environment', 'Plant a tree', and 'Collect waste'. Students work as volunteers to clean roads and plant trees. Recently the college students staged a performance, 'I love Hanoi', to ensure that both the local community and students understand the importance of their own actions in establishing a beautiful and healthy living environment.

Vocational and professional education students in Hanoi support the city's 'Go Green' and take part in 'Green your campus' initiatives where students keep their colleges clean and collect garbage. Youth organisations from different colleges are working with communities to raise awareness of the need to keep the environment clean. Students take part in different events, including educational workshops such as 'Let's go green' for schools and households, and in activities on the solar heating of water, organised by the Vietnam National Association for Environmental Protection. Colleges and polytechnics also organise a 'Green apartment competition' for students who live on campus and present awards to the winners.

In Sri Lanka vocational and professional education institutions organise eco-clubs as extracurricular activities for students. Some vocational and professional education providers set up school environmental committees to deal with greening of campuses. Students are involved in maintaining the institute's gardens before classes. During assembly, students are reminded about the social implications of environmental pollution.

Colleges recognise the need to pay special attention to attitude development. Different strategies are used to remind students of the need to think about environmental protection and act accordingly. On the homepage of the BTL College (Vietnam) website, there is a green message encouraging students to save power consumption of their computers by downloading and using a free software program called Granola that helps reduce power consumption, but does not affect the performance of their computers.

Extracurricular activities including greening of campuses, involvement with local communities, a focus on students' development - not just training - help vocational and professional education providers to progress values and attitudinal change. Therefore, the introduction of generic and specific green skills/competencies in competence-based vocational and professional education should be packaged with other essential components: change in pedagogy, attitude development and greening of campuses.

The majority of the countries in Asia and the Pacific region have been moving towards competence-based education and training. Therefore, industry demand is identified by many vocational and professional education providers as an important drive in adjusting their training programmes on the level of VTPs. However, the demand for green skills has not been detected by many vocational and professional education institutions. They referred to the slow pace of greening in the industry and difficulties in identifying a demand for green skills from employers. Subsequently, it is often challenging to find work-based training places for students. Therefore, current and future gaps in greening skills for many Asian countries can be recognised and summarised as follows (see Fig. 43.2).

The present slow pace of greening technologies in the industry is an important challenge for formal vocational and professional education within the competence training framework. Orientation of competence-based vocational and professional education towards meeting current industry demands is a challenge that holds up the process of greening vocational and professional education. In this chapter, one mechanism that focuses on the government's role in stimulating green innovation

Green skills	Current gaps	Future gaps
All occupations (e.g. hospitality, transport, construction)	Nominal	Potentially significant due to governments' initiatives such as the *National action Plan for Haritha Lanka Program* (Sri Lanka) (National Council for Sustainable Development 2009), *The Viet Nam Sustainable Development Strategy for 2011-2020* (Viet Nam Government 2012), *The Viet Nam National Green Growth Strategy* (Viet Nam Government 2012b)
Green occupations (e.g. clean energy, green transport)	Is recognized	Visible

Fig. 43.2 Current-future gaps in green skills

development and diffusion to support skills demand is examined. The World Bank (2012) argues that developed countries need to invest more in research and development (R&D), and low-income countries should focus on adapting and disseminating developed green technologies. The example of Hong Kong R&D is analysed below.

43.4 Innovation

Greening of existing technologies and working practices is closely related to innovation.

High performance in increasingly competitive global economies, combined with the need to address global challenges posed by climate change, health and poverty requires successful countries to adapt innovative-driven strategies for growth. Innovation – the development and introduction of new or significantly improved products (goods and services), processes or methods (OECD-Eurostat 2005) – is viewed by many governments as an important area of public investment. The Government of Hong Kong SAR has invested strategically in innovation and technology as drivers for economic growth and competitiveness. An Innovation and Technology Commission (ITC) was established in 2000 with the mission of spearheading Hong Kong's drive to become a world-class, knowledge-based economy.

Financial services, trading and logistics, tourism and professional and producer services have been the 'four key industries' driving the Hong Kong SAR economy over the last decade. Innovation and technology is considered among emerging and important growth industries 'generating employment, as well as playing a major role in the transition of economies towards sustainable development'. The value

added by the innovation and technology industry was HK$12.4 billion in 2011 (or 0.7% of GDP) representing a 5.1% growth compared to 2010 (Hong Kong Government 2013).

Hong Kong SAR is ranked seventh in the world in both the Global Competitiveness and the Global Innovation (Cornell, INSEAD and WIPO 2013) indices (GCI and GII). The performance in innovation capacity in the GII is benchmarked against 142 global economies on such criteria as institutional development, human capital and research, infrastructure and knowledge and technology outputs. Innovative capacity is seen as a key indicator of economic growth and development for countries in both global indices. Importantly, innovation encompasses a range of activities beyond R&D, including organisational change, training, testing, work with consumers, development of attractive design, etc. As stated in the *Oslo Manual* (OECD-Eurostat 2005), strategic approaches are required to achieve public policy objectives for innovation. An important component of such strategies is improving the mechanisms to foster the diffusion of innovation (OECD-Eurostat 2010). Five R&D centres were set up by the Hong Kong Government 'to drive and coordinate applied R&D in selected focus areas and to promote commercialisation of R&D results and technology transfer' (Hong Kong Government 2013). Some results of the interviews with high-ranking managers of two R&D institutions, The Hong Kong Automotive Parts and Accessory Systems (APAS) R&D Centre and The Nano and Advanced Materials Institute Limited (NAMI), are reported here.

43.4.1 Green Innovation

The current study on human resource development and green innovation in Hong Kong (Pavlova 2015) identified a close relationship between innovation and green innovation and the importance of government's support of innovation and its diffusion in creating a technological push. The respondent from Nano and Advanced Materials Institute (NAMI) stated that over the last three years, more than half of NAMI's projects could be classified as 'green'. Through this innovation, companies reduce material cost and increase efficiency. For example, NAMI developed a new technology for producing concrete, so the quantity of materials required has decreased as well as the cost and production time. NAMI is also recycling waste and transforming it into building materials. In the environmental technology sector, they have some innovation on air filters and water purifier technologies. Under sustainable energy projects, they focus on energy saving. They have large-scale projects on solar energy. However, the nature of the projects is 'constrained by the market needs', as approximately 30 % of their activities are collaborative research projects, where at least 30 % of the budget should be contributed by the industry partner interested in innovation. Mainly, this interest is pertinent to 'reducing costs of materials and increasing efficiency' to save and to increase profit.

NAMI uses a mechanism of seed projects (that do not require industry funding and are funded by NAMI alone), where they have flexibility in developing their own

agenda for research, although the results should be potentially interesting to the market. While these projects are small in terms of their financial funding, they constitute about one third of all projects, and around one fifth of these projects are green. Through these projects, new core technologies are developed that can be used later for collaborative projects. NAMI focuses its research on sustainable energy, environmental technologies, construction/building materials, solid state lighting and display and bio and healthcare products.

APAS reports that although they do not often classify innovation as green, their R&D is aimed towards improving efficiency and decreasing the usage of materials and waste. So in a sense, a lot of their projects are green. APAS representatives believe that 'innovation and greening are closely related' because innovation, for example, reduces waste or helps to manage energy better (e.g. through 'packaged energy density' in a battery system). The proportion of green innovation over the whole period of APAS's functioning is around 50 %. In the last year, this has increased to around 55 %. This relatively high proportion of green projects was unintentional and occurred despite the absence of a 'specific government policy pushing for green innovation' in R&D. APAS evaluates the market and can detect a 'demand in this area'. Therefore, the growing importance of greening is the main reason for R&D projects in these areas. In terms of seed projects, currently around 40–45 % of projects are green (they reduce environmental impact of economic development). Previously, the percentage was lower. Planning of research is based on five-year road maps. The current plan, completed in mid-2014, focused on three areas: basic battery system design, the overall electric vehicle system control and charging infrastructures. The next five-year plan has its main focus on green transportation.

These examples demonstrate that there are very close links between innovation and greening/green innovation. In some sectors, R&D institutes detect market needs in greening, so they respond by focusing on green innovation that is labelled as green. They have a balanced supply-driven R&D (seed projects) and demand-driven (collaborative, platform and contract research projects) approaches for innovation. The 'technology-push' approach through supply-driven research provides a good opportunity for further development of green technologies.

Diffusion of innovation (or commercialisation) is an essential component at R&D institutes. When Intellectual Property Rights (IP) are held by the industry partners (usually if they contribute more than 50 % of the project budget), they are in charge of commercialisation. Often, these requirements are stated in the project activities (NAMI). When IP are held by R&D institutes, they take measures for innovation diffusion, by searching for interested companies and going through the process of licensing. In addition to displaying ready-to-market technologies on their websites, R&D centres showcase their technologies at their own trade shows, at events organised by the government (large annual activities) and trade unions. As a new initiative, NAMI is planning to make videos about their products to publicise the results.

APAS has two branches, one is R&D and the other commercialisation. Diffusion of innovation is viewed by the institute as an essential activity. Through the

commercialisation branch, APAS promotes R&D work, in particular IP generated by the institute's projects. In addition, they also establish contacts with industries to formulate new projects based on previously completed work. To attract new partners, they use their personal network, organise seminars and conferences and reach industry through a published newsletter with updates on the latest technologies. They also work directly with the Hong Kong Institute of Patent Attorneys (HKIPA), which is a professional body that involves 150 industry members, including some in China.

One government initiative that was stated by both R&D institutes through the interviews is the *Public Sector Trial Scheme*. Government provides additional funding support for production of prototypes/samples and conducting of trial schemes in the public sector. This creates an opportunity to showcase innovation to the general public and companies. A recent example referred to by APAS is a 'Vehicle ADAS' (Advanced Driver Assistance System) that helps to increase safety when driving. A system of warning signals is used. The prototype was given to a non-profit organisation that organises driving services to people with disabilities. After the trial APAS used a driver's feedback together with photos that reflect peoples' experiences for promotions. This approach helps to diffuse R&D outcomes and 'turns them into real commercialisation opportunities' (an interview). R&D institutes can apply to the government to cover 30 % of the project cost. This scheme was established two years ago and is claimed by NAMI as very effective. Recently, the government increased its support to 50 % to reduce industry's risk associated with innovation. Another government initiative is a cash rebate scheme that targets industry. Companies can receive 30 % cash rebate of their investment in R&D, which proves to be an attractive proposition to them.

All these measures are aimed at stimulating green restructuring that in turn requires greening of skills due to the introduction of new technologies. As a result, vocational and professional education providers receive signals from companies that the development of new skills and topping-up existing skills is required.

43.5 Conclusions

Inclusion of green skills into competence-based vocational and professional education is an important foundation for greening vocational and professional education and economies. Two types of green skills (core green competencies) and specific competencies have been identified as important for inclusion into competence-based education and training. The research also demonstrates that despite multiple examples of inclusion of new green competencies both generic and specific into curriculum, along with some emphasis on the development of attitudes, there is a need for the implementation of a holistic framework for greening vocational and professional education. A model that supports green competency inclusion in vocational and professional education practices at the institutional level was created. A particular emphasis on the development of values and attitudes is required.

In addition all enablers that are required for the implementation of any change in vocational and professional education such as teacher education and professional development, quality assurance and assessment mechanism should be in place.

While industry is slow in reorienting itself towards greening, government is playing a crucial role in adjusting vocational and professional education towards the needs of economy (both current and future), individuals and societies. Orientation towards a greener future could increase general awareness and readiness for greening. Industry demand is essential for competence-based vocational and professional education; therefore, governments' leadership in stimulating green innovation and its diffusion in industries is particularly important. As the example of Hong Kong demonstrates, often innovation is not labelled as green innovation, although it decreases the amount of material or energy used, limits waste and improves productivity by reducing the consumption of resources. Therefore, by supporting R&D, developed countries such as Hong Kong increase their opportunity to advance greener technologies and products. A broad dissemination of these innovations allows green restructuring of economies. Putting an emphasis on establishing links with developing countries could help to introduce greener technologies there and to stimulate demand in green skills. Initially these new technologies will require on-the-job training for topping-up existing skills; however, gradually they will find their way in formal vocational and professional education and training either through work practicums or units/modules of competence. This transition will be supported by effective mechanisms for updating occupational profiles and training packages that should be in place in all countries.

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Chapter 44
Complex Problem-Solving in a Changing World: Bridging Domain-Specific and Transversal Competence Demands in Vocational Education

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44.1 Introduction

The general aim of today's vocational and professional education is the preparation of individuals for the world of work (e.g. Billett 2011). In this chapter, we highlight current trends in cognitive skill assessment and explore the benefits of relating them to well-established approaches to learning and instruction in vocational education. More specifically, we look at assessment approaches originating in cognitive psychology that utilize computer-simulated microworlds for the estimation of skills directed at an individuals' interaction with complex problem situations: complex problem-solving (CPS). We inquire whether, and how, vocational and professional education can utilize some of the underlying principles and problem features.

Compared to some decades ago, what the world of work vocational and professional education is trying to prepare for is undergoing tremendous changes (e.g. Autor et al. 2003; Cascio 1995; Spitz-Oener 2006). In a well-received study, Autor et al. (2003) identified general trends in the kinds of tasks individuals face at their daily work place during the last decades. Specifically, they highlighted a continuing decline of routine manual and cognitive tasks, accompanied by a corresponding

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increase of nonroutine and interactive tasks. That is, occupations and jobs consisting of tasks that can be described by straightforward routines are in retreat, while at the same time, the need for analyses, problem-solving and dealing with unexpected and changing situations is rising (see also the update by Autor and Price 2013).

Autor et al. (2003) exemplify these changes by describing the role and work tasks a secretary used to perform some forty years ago and comparing these with the role and work tasks secretaries accomplish nowadays. To this end, Autor et al. build among other sources on the Department of Labor's Occupation Outlook Handbook, whose entry in 1976 read 'secretaries relieve their employers of routine duties so they can work on more important matters. Although most secretaries type, take shorthand, and deal with callers, the time spent on these duties varies in different types of organizations' (US Department of Labor 1976, p. 94). The corresponding paragraph in 2000 in contrast reads:

> The role of the secretary has greatly evolved. Office automation and organizational restructuring have led secretaries to assume a wide range of new responsibilities once reserved for managerial and professional staff. Many secretaries now provide training and orientation to new staff, conduct research on the Internet, and learn to operate new office technologies. (U.S. Department of Labor 2000, p. 324)

As one of the consequences of the shift in responsibilities and work tasks, the education and training secretaries require is quite different from the one that was necessary in 1976. Word processors including advanced automation features for inserting addresses from a database into a letterhead have reduced to importance of some skills, while the systematic search for information on the Internet requires new skills and motivation to engage with digital technology.

Similar trends have been identified across domains, organizations, countries and scientific disciplines highlighting the move towards tasks that cannot be handled by utilizing standard solutions or routines (e.g. Goos et al. 2009; Ikenaga and Kambayashi 2010; Spitz-Oener 2006). The reasons for this shift towards nonroutine and interactive tasks are manifold (e.g. changing consumer demands, computerization and/or offshoring of repetitive tasks (Autor and Dorn 2013; Baumgarten et al. 2010; Becker et al. 2013), but importantly for this chapter, education – including vocational and professional education – needs to adapt to the corresponding shift in work tasks. At first glance, there seems to be a potential tension between preparing students for a certain vocation with associated learning trajectories, qualifications and assessments (e.g. specific knowledge preparing the student how to analyse a broken down car or bake a cake), on the one hand, and preparing for a world in which one of the constant factors is change, on the other hand (e.g. how to engage, contribute and be critical in innovative, entrepreneurial or sustainable practices in relation to analyzing a broken down car). The trend towards competence-based vocational education can be seen as one sign of such adaptations to requirements of stability and change (e.g. Boreham 2002; Brockmann et al. 2008b; see also, e.g. Weick and Sutcliffe 2007 for an organizational perspective), and in this chapter, we will explore how the insights from a different field, namely, complex problem-solving (CPS), might facilitate this process of adaption, especially in light of assessment efforts.

44.2 Competence-based Vocational Education

Vocational education can look back on a long and diverse history of preparing individuals for the requirements of the working world. Going back to the shifts after the end of the guild system, vocational education has its roots in the developments of industrialization and the need for qualified workers there. Hence, at the beginning of the twentieth century, vocational education was mainly targeting the training of narrow and highly standardized skills, following behaviourist models of thought and embedded in a Taylorist industrial model.

At the same time and contrasting to this narrow view on occupations and work tasks, movements towards identifying broader and encompassing abilities not linked to a specific stimulus–response connection can be also traced back to the early 1920s, also giving birth to early research on the role of more general abilities in work, such as intelligence (e.g. Scherbaum et al. 2012). Some decades later, these contrasting pictures of human work and the related vocational education either focused on specific requirements of a task at hand, and the necessary skills for these tasks or a holistic view encompassing the development of broader competencies including personal growth in the tradition of Humboldt still dominate the debate on vocational education (e.g. Biemans et al. 2004). Correspondingly, national differences continue to be large in this respect due to differences in dominant views in industry and policy (e.g. Biemans et al. 2004; Brockmann et al. 2008a, b).

Over the last decade, the notion of competencies as integrated capabilities has become very popular in the modern European literature on competence. We chose to utilize Mulder's working definition of competence for our chapter (Mulder 2001; and Chap. 1 in this volume): 'Competence is the capability of a person (or an organisation) to reach specific achievements. Personal competencies comprise integrated performance-oriented capabilities, which consist of clusters of knowledge structures and also cognitive, interactive, affective and where necessary psychomotor capabilities, and attitudes and values, which are required for carrying out tasks, solving problems and, more generally, effectively functioning in a certain profession, organisation, position or role' (Mulder 2001, p. 152).

Following this definition, competence-based education 'implies creating opportunities for students and workers, close to their world of experience in a meaningful learning environment (preferably professional practice) where the learner can develop integrated, performance-oriented capabilities for handling the core problems in practice' (Biemans et al. 2004, pp. 530–531). Moreover, competence-based education is linked to an assessment culture in which knowledge is viewed as a relative and subjective concept that an individual or a community develops in a certain social and cultural context (e.g. Birenbaum et al. 2006, Honebein et al. 1993; see the chapter by Spöttl and Musekamp in this volume for an example in the context of mechanical engineering). Characteristics of these competence-based assessments are that (1) there is a direct link with professional practice, roles and tasks representative of this professional practice, (2) assessment is individualized and (3) students are actively involved in the development and use of assessments (Birenbaum et al. 2006, Segers and Dochy 2001).

44.3 Current Trends in the Broader Context of Formal Education

In the broader context of (school) education, the shifts in the working world have led to a greater emphasis on skills that allow individuals to cope successfully in situations requiring more than the 'mere' acquisition and application of domain-specific knowledge and skills such as creativity, critical thinking and problem-solving. Efforts targeting these so-called twenty-first-century skills from a lifelong perspective have been gaining increased attention recently, for example, leading to the research programme initiated by the National Research Council in the United States as a visible sign (National Research Council 2012; see also e.g. Griffin et al. 2012).

To provide an empirical basis for planning and evaluation, and complementing the implementation of such programmes, educational large-scale assessments increasingly broaden their scope as well. One of the most important large-scale assessments worldwide, the OECD's Programme for the International Student Assessment (PISA), to give an example, has been including a range of constructs alongside the assessment of the classical school domains mathematics, science and literacy. In 2009 the assessments included electronic reading skills, targeting the students' capabilities to put their reading skills to use in an environment as found, for example, when searching for information on the Internet (OECD 2010). Going further, in 2012, PISA included an assessment of problem-solving, targeting skills allowing students to successfully handle everyday problem situations, such as operating a ticket machine or finding the shortest route between two cities, without relying on domain-specific knowledge, for example, from mathematics (OECD 2014).

Importantly for the case of vocational education and the high relevance of domain-specific competencies there, these problem-solving assessments have their counterparts in various domains, translating the insights from domain-general problem-solving assessment into palpable insights embedded in the respective domain. For example, Scherer and Tiemann (2012) used problem features and assessment approaches pioneered in CPS assessment in the context of problem-solving in a chemistry-specific virtual environment (e.g. Greiff et al. 2012). Specifically, building on an assessment differentiating analytical and interactive problem-solving and a virtual environment simulating a chemistry laboratory, they were able to investigate students' domain-specific problem-solving behaviour in an environment where students are required to deal with critical features of complex problems against the background of a specific school subject and with the help of procedures and tools central for this subject. This way, Scherer and Tiemann (2012) were able to investigate the structure of domain-specific problem-solving competency and its relation to metacognitive processes.

Large-scale assessment efforts after formal education are beginning to emerge as well, in spite of the heterogeneous nature of important domains, occupations and life courses. These initiatives may serve as a point of departure for empirical analyses of lifelong learning efforts after school (e.g. PIAAC, ALL). Naturally, these assessments are less bound to the structure and domains as taught in schools and

include, for example, estimations of individual skills in handling modern information technology or analytical problem-solving assessments.

With regard to vocational and professional education specifically, the general potential and boundaries of conducting large-scale assessments have been explored successfully on a conceptual and initial empirical level (Baethge et al. 2009; Nickolaus 2011). In their comprehensive international study, Baethge et al. (2009) compared critical work tasks, qualification requirements and learning outcomes of four groups of occupations and the related vocational education in several European countries: there seems to be enough overlap between occupational tasks and the corresponding education across countries, educational regimes and occupations to justify large-scale assessment efforts also for vocational and professional education.

44.4 A Potential of Problem-Solving Research Focused on Vocational Education?

But can we connect the potential of large-scale assessments in vocational and professional training with the need to prepare students for an ever-changing world of work? In line with the expansion of educational large-scale assessments towards the direction of general problem-solving skills in schools, we expect new insights and a more comprehensive assessment to be possible if the factors included in general problem-solving assessment are taken into account in assessments in vocational and professional education. Comparable to the combination of domain-specific competencies with general characteristics of problem-solving assessment in Scherer and Tiemann (2012), we strongly believe in the potential and benefit of similar approaches also in the realm of vocational and professional competence-based education. Fortunately enough, some first steps towards this combination of general problem-solving skills and vocational and professional education have been already undertaken.

Looking for an empirical overlap between domain-general problem-solving skills and domain-specific competencies in vocational education, Abele et al. (2012) successfully compared the assessment of technical problem-solving skills of automotive mechanics with an assessment of domain-general problem-solving skills. Conceptualizations of competencies in various occupations oftentimes include some kind of domain-specific problem-solving skills (cf. the overview in Nickolaus 2011, p. 334, see also the chapters by Ștefănică, Abele, Walker and Nickolaus and the one by Spöttl and Musekamp in this volume) but also rising degree general problem-solving skills. Unfortunately, these application-oriented domain-specific problem-solving competencies are (empirically) much less researched compared to domain-specific knowledge, mainly due to methodological difficulties. Generally speaking, it is much easier to assess (declarative) knowledge via questionnaires or tests (e.g. asking for a typical engine problem in a multiple choice test), compared

to an assessment of problem-solving performance when applying this knowledge to typical problems of the domain (e.g. assessing whether the student can actually identify the problem in an actual car), which is especially true for the case of dynamic or complex problem situations. At the same time, it is this practical side of applying vocationally relevant knowledge in typical problem situations that is preparing students in vocational education for their later working life, where they not only need to know about potential problems but also need practical routines, problem-solving strategies and an encompassing set of personal and social competencies to overcome them (e.g. BMBF 2011; Reetz 1999, see also the chapter by Ștefănică et al. in this volume).

The example of Abele et al. (2012) shows the feasibility of assessing domain-specific problem-solving competencies with the help of computer-simulated problems simulating critical situations taken from typical tasks of an occupation (see also Gschwendtner et al. 2009; Nickolaus et al. 2011). In their study, they utilized a computer-simulated car to confront participants with typical problem situations automotive mechatronics have to deal with on a regular basis (e.g. the engine failing to start). A second sample of electricians was confronted with similar computer-simulated problem from their field. The problems thereby required specific occupational knowledge, as well as suitable domain-specific problem-solving routines in an environment that resembled a computer-simulated version of an actual problem from the specific domain, even if focusing on the analytical part of problem-solving competencies. Both computer-simulated problems have been shown to exhibit empirical convergence with assessments on actual problems (Gschwendtner et al. 2009; Nickolaus et al. 2011). What makes the study of Abele et al. (2012) even more interesting is the inclusion of assessments directed towards domain-general complex problem-solving, reasoning skills, as well as domain-specific knowledge within one empirical study. Thereby, they were able to distinguish between domain-general and domain-specific empirical relations included in each form of assessment, which in turn should be relevant for conceptualizations of competencies spanning across occupational boundaries. Especially in light of requirements relevant in multiple occupations (i.e. sustainable or entrepreneurial behaviour), such insights should be highly valuable when compared across occupations and can be considered one step towards preparing students for changes in their future working lives.

Naturally, the study of Abele et al. (2012) is by no means a final answer in the quest for sustainable, entrepreneurial or innovative practices in vocational education, but it may serve as a positive example. The translation and combination of insights from domain-general complex problem-solving assessment with domain-specific competencies as relevant in vocational education might be opening the door towards an integration of insights towards broader competencies applicable also in unforeseen problem situations but assessable in large-scale efforts of assessment. Even more promising seem studies combining the possibilities highlighted by CPS assessment with an assessment embedded in relevant problem scenarios of specific occupations. Thereby, analyses of problem-solving going beyond analytical problems become possible, extending the range of requirements to more dynamic and

complex problem situations, potentially including, for example, those directed at entrepreneurial, innovative or sustainable behaviour. But what are these features of CPS assessment we deem worthy of more attention in vocational and professional education and assessment in this context?

44.5 Features of Complex Problem-Solving Assessment

CPS as a construct originates in research on human interactions with problems from a cognitive perspective (Novick and Bassok 2005, see also Fischer et al. 2012). Hence, it is focused on general patterns of human interactions with problems and contrasts, for example, with approaches dedicated to human behaviour and problem-solving in specific problem-solving situations or environments (oftentimes referred to under the label of naturalistic decision making, e.g. Klein et al. 1993) but also conceptualizations of problem-solving as part of domain-specific competencies in specific occupations (see above, but see Fischer and Neubert 2015).

What differentiates CPS from other approaches within a cognitive perspective is the focus on problems that include a range of features setting them apart from 'simple' problems typically used in problem-solving research (e.g. the Tower of Hanoi, see Novick and Bassok 2005). More specifically, the problems focused on in CPS research are characterized by complexity (i.e. multiple elements), dynamics (i.e. the problem changing on its own or in consequence to user interaction), intransparency (i.e. not all information being available at the outset), interrelatedness (i.e. changes in one part of the problem leading to changes in other parts, too) and politeness (i.e. multiple goals requiring attention; see Fischer et al. 2012). On this rather superficial level, we can already see the overlap to developments in the working world towards nonroutine work tasks and a rising importance of problem-solving skills (see also Neubert et al. 2015).

Following the widely used definition by Buchner (in Frensch and Funke 1995), CPS is therefore 'the successful interaction with task environments that are dynamic (i.e., change as a function of user's intervention and/or as a function of time) and in which some, if not all, of the environment's regularities can only be revealed by successful exploration and integration of the information gained in that process' (Frensch and Funke 1995, p. 14). Again, the processes targeted within CPS research seem to overlap to a great deal with requirements as included in modern work environments characterized by a rising amount of problem situations that require active exploration and the integration of multiple sources of information.

Empirically, CPS has been shown to be distinct from reasoning ability and other (non)cognitive constructs (e.g. Greiff et al. 2014; Greiff and Neubert 2014; Sonnleitner et al. 2013; Wüstenberg et al. 2012). Furthermore, it has a proven track record in predicting real-life criteria of successful problem-solving, such as school grades or supervisor ratings in professional contexts (e.g. Danner et al. 2011; Greiff et al. 2013). Nonetheless, research delineating clear conceptual and empirical rela-

tions to competencies as targeted in the various domains of vocational education are only beginning to surface (e.g. Abele et al. 2012, see above).

Actual assessment of CPS is handled with the help of so-called microworlds, simulated on the computer (Greiff et al. 2012, Fischer 2015, see also Brehmer 2005). Thereby, it becomes possible to include features in assessment that are impossible to implement in paper and pencil assessments, such as a dynamically changing environments that require the consideration of feedback in problem-solving. In addition, the simulation of problems on computers reduces the effort necessary for assessment, both in terms of time and resources, compared, for example, to an assessment of problem-solving featuring real-life problems (see also Gschwendtner et al. 2009; Nickolaus et al. 2011). For example, consider a rather simple MicroDYN task, an instrument targeting CPS (see Greiff et al. 2012 for more details on MicroDYN and Fischer 2015 for a discussion of the general approach). In MicroDYN participants are required to find out about the relations between input variables (labelled without deep semantic meaning, e.g. 'Ceton' and 'Diphon') to output variables (e.g. labelled 'Bolt X' and 'Bolt Y'; see Beckmann and Goode 2013 for a critical view on the effect of semantic embedding). In the assessment situation, perceived relations have to be drawn into a causal model representing the relations between input and output variables, enabling the representation and scoring of knowledge acquisition skills (Blech and Funke 2006). In a second phase of assessment, the knowledge application is targeted, by asking participants to use their gathered knowledge to reach predefined values in the output variables by manipulating the inputs.

MicroDYN problems featuring two input and output variables with simple relations only can be considered rather easy, but complex problems used in assessment can include more variables, connections and types of interactions, for example, variables changing on their own (so-called eigendynamics; see also Greiff et al. 2012, Fischer 2015). Through these changes of the underlying problem structure, the complexity and difficulty of items can be systematically varied, thereby allowing for an adaptation to the skills of the intended target sample. Furthermore, the cover stories used in assessment can be also varied independently of the underlying problem structure, allowing for the comparison of problems across assessments and domains.

One of the big advantages of computer-based assessment is the availability of data showing an individual's interaction with the respective item (e.g. Zoanetti 2010). That is, the actual behaviour can be analysed, for example, in terms of exploration strategies (e.g. Rollett 2008; Vollmeyer et al. 1996). And while their analyses at the moment are mainly restricted to domain-general problem-solving, they offer the potential of additional information on the respective processes of problem-solving, highlighting prevalent misconceptions with regard to specific problems and problem features, as well making needs for intervention and training visible.

Similar items as shown in Figure 1 can be adapted to the respective context with relative ease and are consequently featured in diverse assessment efforts. For example, items following the same paradigm were part of the PISA assessments of

problem-solving in 2012 (OECD 2014), as well as an international project, targeting the CPS skills of employees across a multitude of countries, companies and occupations (LLLigh'in'Europe, see www.lllightineurope.com for more information). Current developments are furthermore expanding the range of available problem features, so that even problem characteristics, such as threshold values, strong interactions of inputs or equilibrium states, can be included within established frames of assessment (Neubert et al. 2014; Fischer 2015).

44.6 Vocational Education Demands and Complex Problem-Solving

We see several ways in which these developments within the context of problem-solving assessment can be brought forward for the benefit of vocational education, thereby blurring the boundaries between research targeting domain-specific competencies, large-scale assessments and general requirements relevant across occupations. In a similar vein, we also expect insights for problem-solving research by learning from vocational education in turn.

First, insights gathered within CPS research might be utilized in vocational education via a more comprehensive assessment of skills and competencies (cf. Neubert et al. 2015). That is, as the working world is moving towards nonroutine and increasingly changing work tasks, an assessment of skills and competencies that allow the successful handling of such situations becomes more important. An example might be the requirements currently featured in CPS assessment, such as the need to consider side effects of one's actions (cf. Fischer et al. 2012), that is, also relevant in the context of, for instance, sustainable behaviour (e.g. Amelung and Funke 2013). In general, we expect a more comprehensive picture of the requirements and competencies faced by todays' vocational education to arise out of this inclusion of problem features currently unaccounted for. On a more theoretical level, problem-solving research in general and CPS research in particular might offer a route for the consideration of new insights from a broad range of fields due to its domain-general approach. That is, CPS might allow for the quicker integration of new insights in vocational education by relying on a common ground in terms of theoretical problem features and similarities in cognitive processes. For example, there will be a growing need for professionals who are able to further strengthen sustainable development in emerging organization or in existing organizations they work for in the coming years. Although the importance of sustainable development is evident, successful engagement in such process is not an easy task. Because of the complexity of problems with regard to sustainable development (e.g. global warming, poverty and hunger, biodiversity decline), they cannot be solved in a simple and unilateral way (see also Amelung and Funke 2013; Lans et al. 2014). They are so-called 'wicked' problems (Dentonia et al. 2012). According to Rittel and Webber (1973), wicked problems, as opposed to tamed problems, are difficult to pin down,

highly complex, and do not have definitive solutions. They have to be approached in an interdisciplinary way by means of collaborations between different stakeholders. That means that solving sustainability problems is a challenge every time and not a matter of routine or automation; every problem or challenge should be studied in its own particular context. This complexity increases even further when taking into consideration that multiple stakeholders are involved, each with potentially conflicting value frames and ideologies with regard to sustainability (Peterson 2009). Stakeholders often fundamentally differ with regard to their backgrounds, visions, goals, motives, etc. (Blok and Lemmens 2015). Once links between CPS and, for instance, sustainable behaviour are established, the inclusion of assessment practices developed in the context of CPS assessment might offer ways towards an empirical examination of these requirements in the context of various vocational education domains.

Similarly, computer-based assessment along the lines of CPS assessment might provide the necessary practical and theoretical foundations for the assessment of domain-specific problem-solving competencies for occupations, where these parts of the respective competencies are currently not included in assessments and hence outside the scope of empirical investigation (Nickolaus 2011). An obvious example is the utilization of computer-simulated problems targeted at the domain-specific problem-solving competencies of automotive mechatronics and electricians as included in Abele et al. (2012). Even if this assessment was restricted to analytical problem-solving, it already provided a viable basis for empirical research of the respective sub-dimension of the competencies. Similar endeavours can be realized with much less effort even when including more dynamic aspects of problem-solving, when built on the insights of already established frameworks and the practical experience of working with computer-based assessment as present in the assessment of CPS (e.g. Funke 2001; Greiff et al. 2012; see also Nickolaus 2011). For example, the use of formal frameworks to describe complex problem situations or the utilization of multiple but reduced complex systems for the sake of psychometric scaling should be transferable to assessments of domain-specific problem-solving in vocational education.

Naturally, this potential for the assessment of new facets of domain-specific competencies needs to be based on a careful examination of work tasks and the identification of typical problems faced in the context of the respective occupation (e.g. via cognitive work analysis; Naikar et al. 2006; Vicente 1999). Going even further, a common ground in terms of assessment procedures might also facilitate the (empirical) comparison of overlapping competencies between various domains building on work analyses of the respective tasks. That is, CPS assessment might offer a practical route towards the empirical examination of possibilities and boundaries of transferability of domain-specific problem-solving routines between specific domains. For example, entrepreneurial practices depend on domain and context-specific knowledge (Shane, 2000). An automotive mechanic introducing new ways of baking bread is as improbable as a baker implementing a new tool for

engine diagnosis. Still, in addition to specific knowledge, one can identify overlapping requirements of entrepreneurial (or sustainable, see above) practices that are of high importance across contexts. And CPS assessment and the associated theoretical foundations might help in identifying these empirically (cf. Baggen et al. 2015; Ederer et al. 2014).

One aspect where we see an enormous potential for both CPS research and vocational education is the area of specific problem-solving processes (e.g. Fischer et al. 2012; Osman 2010). Problem-solving research has a long and successful history of identifying central processes of humans interacting with various kinds of problems (e.g. Novick and Bassok 2005). But recent developments, such as the rise of naturalistic decision making research (e.g. Klein 2008; Zsambok and Klein 1997), clearly show the need for a better accounting of the very specific environments, where the respective problem-solving processes are actually happening. The combination of CPS research and vocational education might prove to be a fruitful interaction in this respect, as it combines the search for general human processes, a strong theoretical rooting in cognitive science and the availability of approaches and tools for their assessment with expertise in very specific problem environments. Vocational education with its rich and encompassing repertoire of domain-specific competencies, careful and empirically validated considerations of competence subdimensions and delineations of knowledge and problem-solving as based on insights in practically important occupational tasks might be an ideal point of departure for further research. CPS research has been incorporating prior knowledge in selected examples on a very general and static level (e.g. Kersting 2001; Kersting and Süß 1995; Süß 1996). But as the insights from naturalistic decision making show, these considerations have underestimated the influence and importance of very specific problem-solving features and processes as relevant in specific problem-solving environments (e.g. Roth 1998). Combining vocational education and the long tradition of work analyses with CPS research might offer fertile grounds for further explorations trying to integrate both strands of research (cf. Neubert et al. 2015).

Finally, there are developments, such as the rising interest in process data gathered during assessment and stored in log files that should be of interest for both vocational education and CPS research (e.g. Zoanetti 2010). A deeper understanding of ways to investigating actual problem-solving processes with the help of this process data might benefit both lines of research, while the two perspectives probably also offer very distinct views on potential limitations and problems associated with such an approach. For example, problem-solving research might benefit from considering individually rooted and situaationally embedded processes of sensemaking when looking for the interpretation of process data (e.g. Weick 1995, see also Brehmer 2005), while vocational education might benefit from the experience of problem-solving research providing a psychometrically sound assessment of skills. It is our hope that a fruitful interaction between research targeting vocational education and problem-solving assessment will lead to better outcomes for researchers targeting either field.

44.7 Conclusions

In conclusion, we see a broad range of potential benefits from a deeper interaction and exchange of problem-solving research and competence-based vocational and professional education. Coming back to a situation of expanding large-scale assessment efforts and the need to account for an ever-changing world of work and the domain-specific conceptualizations of competencies in vocational education, the assessment of problem-solving skills might offer the necessary route forward. But we also see potential benefits for CPS research, when considering domain- or occupation-specific problem-solving processes, thereby gaining a deeper understanding, for example, of the role knowledge plays in the recognition and representation of problems across various domains. Naturally, these benefits have implications for both research and practice.

With regard to research, the need for further investigations is clear. Combining the potential of CPS and vocational and professional education will require a lot of additional work to benefit both fields of research. The previous section on the benefits of an interaction between CPS and vocational and professional education explains which kind of transfer between both domains seems promising to us. Nonetheless, additional work is needed to take advantage of these. For example, to establish an assessment of the dynamic aspects of problem-solving included in various occupations will require theoretical and empirical explorations into the task composition of work, the construction of matching problem simulations based on the frameworks developed within the context of CPS, the piloting of these simulations and finally the empirical application with larger samples of practitioners. This road forward is by no means the 'simple' transfer or application of existing knowledge.

Furthermore, the theoretical and empirical distinction between common and differentiating processes of problem-solving will need to build on matching problem-solving assessments, probably requiring the aforementioned introduction of new measurement instruments for vocational education within various domains and occupations. Only by comparing the results for problem-solving assessments between numbers of occupations can we draw the conclusions on overlapping and distinguishing parts of the problem-solving process. Even more, these inquiries will probably also require additional investments on the side of process analyses, although we can hope for appropriate developments also to occur in other domains of problem-solving research, for example, directed towards formal education in schools.

Finally, identifying successful problem solvers within an occupation requires the selection of appropriate markers of success within these occupational settings, thereby allowing for considerations of ecological and predictive validity (see, e.g. Bartram 2005). And while the case seems easier for general primary and secondary education in school with roughly comparable indicators of success (e.g. Kretzschmar et al. 2014), these indicators are much harder to find for vocational education. And

the problem becomes even more prevalent when trying to find indicators that are valid across a range of occupations and domains. In summary, we see a lot of need for research and, hence, potential for academic progression for both fields, CPS research and vocational and professional education.

With regard to implications for practice, CPS assessment allows for the measurement of domain-general skills that cover important aspects of problem features (cf. Neubert et al. 2015). Economic research points at the fact that these features will be found in future occupations related to complex problems, such as the successful handling of side effects, thereby making them relevant for practitioners in vocational and professional education. Already, we see a rising amount of research promoting new findings from this research to a wider audience, including practitioners in vocational and professional education (e.g. the above-mentioned project LLLight'in'Europe, www.lllightineurope.com, see also Greiff et al. 2015). It is our hope that a closer interaction between researchers from the fields of vocational and professional education and CPS and practitioners will lead to mutually beneficial cooperation.

For the future, we expect practitioners to benefit immensely from the measurement of important skills with a link to both cognitive roots and the respective domain. Exemplarily, this will be relevant in the selection of staff, the identification of training needs and potential career patterns, as well as the targeting of the resulting requirements via training efforts. It is our hope that these combined efforts will lead to the better preparation of competent individuals successfully handling the challenges of future work situations. Naturally, this will depend on both efforts of researchers to establish viable measurement instruments suited for the respective domain of VE and practitioners, in terms of providing the important link to practice and application.

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Chapter 45
Intuition as Crucial Component of Professional Competence: Its Relevance for Competence-based Vocational and Professional Education and Training

Christian Harteis

45.1 Introduction

The central goal of vocational and professional education and training is to develop an individual's skills and capabilities in a way that the individual is well prepared for the demands of the workplace. Even though the demands of different vocations and professions widely differ and vary, their curricula share the purpose of providing individuals those skills and knowledge that allows them to fulfill working tasks in their field adequately. However, during the last two decades, educational policy on how best to follow this purpose has changed. The idea of competence-based vocational and professional education and training replaced the traditional thinking about curricula, which strongly focused the input to (i.e., content of) syllabi, by concentrating to the intended outcome. Such outcome can be described as a catalogue of competencies which a candidate has to demonstrate after completion of a training or education program. This approach to education and training implies assumptions on how best to meet today's and future's work demands. The core of the assumptions delineates to develop an individual's excellence in a vocational or professional field as far as possible, because excellence might be the best precondition for coping with novel challenges.

Expertise research as a particular research approach in educational science and psychology becomes relevant here. This approach analyzes the development from novice to expert by focusing on the establishment, modification, and structure of knowledge on this journey. The crucial characteristic of an expert is his capability to reliably perform extraordinarily in his domain. Hence, experts are considered to cope with challenges better, more efficient, quicker than mediocre performers of a domain. An expert represents the ideal model of a graduate of vocational and

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professional education and training. It is the capability to cope with work demands adequately, which is the key promise of expertise. Following a classical approach of expertise, intuition as the capability to act appropriately without significant cognitive effort is the crucial aspect of expertise. Obviously, the development of high-performance capabilities requires the development of knowledge structures which allow intuitive acting.

45.2 What Makes an Individual Excellent? Characteristics of Excellence

From the perspective of expertise research, three qualities of knowledge and knowing can be distinguished which altogether form an individual's excellence. It is firstly a comprehensive stock of declarative, procedural, and episodic *knowledge* which enables an individual to justify actions appropriately. Secondly, it is an amount of *routines* which enables an individual to cope with regular tasks quickly. Thirdly, it is *intuition* as the capability also to appropriately cope with novel challenges.

45.2.1 Comprehensive Stock of Knowledge

Experts possess an extraordinary amount of knowledge which is remarkably well embedded in their memory. This knowledge is domain specific and is developed through utilizing learning opportunities and practice settings within the domain for establishing, modifying, and consolidating knowledge. Classical studies on experts' memories in the domain of chess reveal their impressive memory performance (Chase and Simon 1973a, b; Gruber 1999) which can be explained by experts' extremely well-structured stock of knowledge that allows them to integrate novel information effectively so that it can be recalled reliably. Experts succeed this task because they are able to quickly relate novel information with familiar information stored within their long-time memory. Expertise research distinguishes various qualities of knowledge which extend the common understanding of knowledge as being declarative knowledge. Expertise research further construes procedural knowledge as knowledge on operations (how to do things) and episodic knowledge as knowledge on situations in which something happened (the circumstances of doing). It is the interplay between these forms of knowledge and learning which generates the fundament of experiential knowledge (Gruber 2001; Kolb 1984) that enables experts to perform extraordinarily.

45.2.2 Routines

Experts' capability to apply a comprehensive knowledge stock in problem-solving makes experts familiar with a multitude of situations. Familiarity implies that experts possess a repertoire of routines which can be (usually successfully) applied in these situations without requiring much awareness and concentration. These routines are regularly objects of mental control and evaluation, because experts judge the success of routine application afterward, and they spend time in simulating the application of routines mentally when reflecting about their domain (Klein 2003). The development of routines usually requires intensive exercising not as pure accumulation of practice but as deliberate development of procedural knowledge structures and cognitive schemata which comprise automated action patterns. Expertise research introduced that kind of exercising as deliberate practice (Ericsson 2006; Ericsson et al. 1993) which is a core construct of expertise development which will be discussed below.

45.2.3 Intuition

Dreyfus and Dreyfus (1986) developed a highly acknowledged model of expertise development, of which the highest level is characterized by intuitive action which does not demand the engagement in conscious efforts, nor demand thought or reflection, nor even demand awareness by the experts. Intuition enables experts to cope effectively with novel challenges. Intuition is factually based on a comprehensive stock of knowledge and the availability of routines, but this is not a sufficient explanation of intuition. Routines and automatism namely can explain the capability of already known problems only, as they were created and established by solving former problems. Intuition, however, describes that quality of knowledge which influences decision-making under conditions of uncertainty, pattern recognition within complex stimuli, and inventing novelties. Intuition, hence, goes beyond routines and automatisms.

45.3 A Theoretical Classification of Intuition

It is about 10 years ago that intuition internationally became an issue of public awareness. International bestsellers discussed intuition and its fascinating facets in various domains of public interest (e.g., Gladwell 2005; Klein 2003). However, scientific analyses of intuition have a long tradition since the beginning of the twentieth century (e.g., Jung 1923; Weston 1927). Nowadays, a variety of newly developed and empirically informed approaches on intuition developed in educational science, psychology, or business education (e.g., Asvoll 2012; Eisenkraft 2013;

Sadler-Smith 2010; Sinclair 2011, 2014). Of course, all these scientific approaches of investigating intuition are situated in different academic and practical contexts. Hence, it is important to develop a precise understanding of intuition in its form, potential, and development, in order to utilize intuition for competence-based education and training.

A general definition of intuition refers to an individual's capacity to act or decide appropriately without demanding a deliberate and conscious balancing of alternatives as well as, simultaneously, not simply following a rule nor a routine (Harteis and Gruber 2008; Hogarth 2005; Kahneman and Klein 2009). In other words, intuition comprises the capacity to do the right things in even novel situations without necessarily demanding awareness. There is rich literature with impressive examples of intuition – e.g., the landing of an aircraft at the Hudson River in 2009 (Sadler-Smith 2010), the detection of an antique forgery against several approval reports (Gladwell 2005), and the firefighters' crucial decisions in action (Klein 1998) – and all of them indicate that there is a variety of intuitive actions. It is not only sportsmen's spontaneous reactions or professionals addressing very nonroutine situations very efficiently, intuition also comprises the enactment of activities which had not been exercised before and then rehearsed. They rather have been invented in situ, just when they were required. In the following, a theoretical frame is to be presented allowing the distinction of these different kinds of intuition.

45.3.1 Cognitive Theories on Intuition

Within psychology, the cognitive lens on intuition has a long tradition. It was Jung (1923) who introduced the consideration of intuition as a mental function of perception which enables individuals to gain a holistic insight of a complex situation. Weston (1927) understood intuition as "perception, not so much of theories as of *sense* regarding the matter in hand" (p. 28, emphasis i.o.) and explained in this way individuals' capabilities to detect lies or to forecast economic development which both he considered to be accessible rather to feeling than to knowing. On this basis, he also seized the antagonism between intuition on the one hand and rationality on the other. However, nowadays theories – as to explain later – rather suggest a different view. However, this early understanding of intuition as a cognitive issue prepared Westcott's (1968) approach to interpret intuition as a specific kind of perception and thinking which is different from deliberate analysis. Intuitive and deliberate concentrated mental activities have to be distinguished; they are different but no antipodes. This distinction refers to knowledge bases which differ in their accessibility. Psychology also holds a long history of reflecting conscious and unconscious mental processes guiding human behavior. Reber (1993) focused unconscious mental processes in his seminal research on implicit learning. He claims that unconscious processes, such as intuition, antedate development of conscious thought. Hence, they are likely to be central to a range of cognitive functions and sources of human development (e.g., Lakoff and Johnson 2003).

However, as these processes are not readily accessible through conscious means (i.e., recall in interviews or surveys), they tend not to be the focus of either empirical work or informed discussion. Indeed, Reber (1993) holds that "the conscious awareness that individuals have about such implicitly acquired knowledge is only a small portion of the total knowledge available to them for guiding behaviour" (p. 34).

> He also claims that … from this evolutionary perspective, a number of fairly strong conclusions about the cognitive unconsciousness are easily reached. Firstly, virtually every interestingly complex organism will be endowed with a powerful, covert, information gathering system that has critical epistemological functions. Second, the neurophysiological structures that form the functional foundations for this implicit system are evolutionarily ancient and antedate those that subserve the explicit, conscious systems (p.40).

It is important to notice that Reber (1993) describes perception as implicit learning that occurs naturally and, hence, ordinarily when an individual perceives a (complex) structured stimulus and largely without a conscious attempt to learn. However, this is a typical way of experiential learning. The resulting knowledge base, then, is mostly held tacitly and unconsciously.

Such an understanding of intuition suggests that intuition utilizes a rich fundament of tacit knowledge gained through experiential learning. This knowledge stock differs from that kind of knowledge developed through deliberate learning efforts. It is based on complex cognitive patterns which are not representable as conscious awareness (Myers 2002). Both kinds of knowledge are important but they differ in quality and function. First one enables individuals to make sense of a situation spontaneously, and second one provides insight on the basis of reflection and concentration (Hogarth 2001). The theory of action regulation (Hacker 1985) focuses planned human behavior and claims that such behavior can be regulated on various levels of (un)consciousness by addressing different kinds of knowledge stock situatively. However, all these precepts suggest that intuition is not only restricted to extraordinary performing individuals, it is a rather normal capacity of human thinking and acting and may be commonly applied across human behavior and, thus, particularly in most forms of vocational and professional activities.

45.3.2 Dual-Mode Theory of Information Processing

A prominent approach of research on decision-making claims dual modes of information processing as fundamental quality of human mind (Bruner 1962; Kahneman and Frederick 2002; Sloman 2002). It claims that the human mind comprises two parallel, permanently operating thinking modes of which one is considered to be the analytical or rationale mode and the other the heuristic or intuitive mode. This account links well to the precept of Hogarth (2001) or Myers (2002) that intuition utilizes tacit knowledge and is not depending on awareness and conscious thinking. This thinking mode processes information quickly and spontaneously by applying implicit knowledge patterns. The analytic thinking mode, in contrast, demands awareness as well as conscious thinking and is, thus, slow. Both modes are

operating in parallel and are interrelated. Since the intuitive mode works spontaneously and quick, it guides human perception by unconsciously distinguishing relevant and irrelevant stimuli. On the other hand it is assumed that deliberate thinking can overlay input provided by the intuitive mode. Each decision, hence, is influenced by both thinking modes. Hammond (1993) introduced the idea to consider a continuum of consciousness which holds on the one end pure intuitive mode, completely free from analytic inputs, and on the other end pure analytic mode, completely free from any intuitive input. Each decision can be located on a certain point of the continuum, whereas pure intuitive or analytic decisions cannot be realized.

There is convincing evidence for this dual-mode theory. In their early common work, Kahneman and Tversky (1972) investigated the interesting phenomenon that individuals estimate things quite poorly in areas where they are usually considered to be competent. Later they could show that test persons are able to believe simultaneously in two statements which contradict each other – without perceiving cognitive dissonances (Tversky and Kahneman 1983). The dual-mode theory "depends critically on the fact that the perception and the knowledge are maintained simultaneously" (Sloman 2002, p. 385). Pictures with optical deceptions usually utilize irritations caused by imaginary three dimensionality which makes lines of similar length appear to be of different length. Even though observers receive proof of length similarity, the spontaneous perception (mediated by the intuitive mode) tends to stick to the assumption of length differences. Hence, even though observers (analytically) know that lines are similar, they still tend to perceive differences against all conscience.

The particular relevance of intuition for competence-based education and training is based on the idea that appropriate intuitive decision-making is a matter of learning, as the research on expertise suggests.

45.3.3 Intuition as Highest Level of Expertise

Research on expertise usually analyzes and explains modifications of an individual's knowledge structures during the development from novice to expert. Starting point for expertise research have been studies on chess that were conducted in order to better understand the role of memory in extraordinary performances of perception and recognition (Chase and Simon 1973a, b). They showed that experts' advanced performance is to be attributed not only to their bigger amount of knowledge but rather to their convenient knowledge structures developed through experience. These studies have gradually been replicated and adopted to various vocational and professional domains. Findings convincingly suggest that experts' decision-making does not always completely follow rules of rationality (Simon 1955) and that experts recognize meaningful patterns within complex situations that allow them to react spontaneously in a way novices are unable to do. On these bases, the

idea of intuition as recognition arose and was established (De Groot 1986) on the premise of knowledge that had been learnt over time and was, in part, rendered beyond immediate consciousness.

As mentioned in Sect. 45.2.3 of this Chapter, Dreyfus and Dreyfus (1986) developed a well-recognized five-step model of expertise development, of which the highest level is characterized by intuitive action which does not demand the engagement in conscious efforts, nor demand thought or reflection, nor even demand awareness by the experts. Their knowledge is developed over time by experience and eventually by engagement within a professional domain of occupational activities. A well-known example they quote refers to chicken sexers who work at chicken farms and distinguish male and female chicken at the age of a few days on a basis in which rational descriptions seem to fail. This profession was imported from Japan, where chicken sexing has a long tradition and an apprenticeship that focuses on a long process of implicit learning by doing and enculturation, and refers to the Far Eastern Zen philosophy (Lunn 1948). Qualified chicken sexers can identify the gender of 2,000 chicks in one hour with a level of 98 percent accuracy (Biederman and Shiffar 1987). However, these workers are unable to report their decision rationale; they are just doing it (Schroeder 1933) intuitively (Dreyfus and Dreyfus 1986). This suggests that the basis of the recognition to which Simon (1982) refers is rendered unconscious as with so many other procedural capacities (e.g., driving a car). However, it is important to acknowledge that not all of the instances of impressive intuitive performance are aligned to repeatedly practiced and procedural capacities. It is an important capacity of experts to solve novel challenges they did not experience before (e.g., the landing of an aircraft on the Hudson River mentioned before). Hence, it is necessary to go beyond accounts of highly practiced procedures to understand what constitutes intuition.

45.4 How Best to Support Intuition?

The sections above elaborated intuition as a crucial and tacit quality of knowledge which enables experts to perform at an excellent level. Competence-based vocational education and training should be oriented toward such a level of performance. Hence, the question arises on how best to support the development of intuition. As main component, the development of experiential knowledge was identified above. Again, the wide area of research on expertise provides helpful suggestions on how to support the development of such experiential knowledge. *Deliberate practice* is considered to be a main contributor to the development of expertise; furthermore, the literature claims that *mental simulations* are fruitful to establish routines; finally it appears that *social embedding into a community of peers* is a necessary precondition for tuning and updating automated knowledge stocks.

45.4.1 Deliberate Practice

Deliberate practice as planful and intentional application of knowledge, routines, and practices aims at experiencing on one's capabilities and limits, in order to establish, consolidate, or modify knowledge. However, Ericsson et al. (1993) consider the importance of deliberate practice for expertise development and claim that these exercises are to be maintained over a long period in order to enable learners to perform at an extraordinary level. Expertise research discusses a thumb rule that 10 years (or 10,000 hours) of practice is needed as a prerequisite for expert performance, a time span, hence, which is much too long for regular education and training. However, a crucial finding of Ericsson et al. (1993) was that experts differ from regular performers especially in the early phase of their expertise development, when they were much highly motivated to learn and develop comprehensive knowledge and they were much more committed to a teacher as an expert role model. The teachers are important for the learners' persistence in learning activities and for providing feedback and guiding learners to appropriate learning goals which are to be reached by deliberate practice, resulting in gradual improvement through repetition and the extinction of mistakes. The basic implication of deliberate practice, thus, is that expert development occurs gradually and that teachers crucially contribute to substantial improvement as coaches and tutors – especially in the early phase of expertise development (Lehmann and Ericsson 2003). Teachers can assist learners in the development of procedural knowledge, in the compilation of declarative knowledge to procedural knowledge, in the adjustment of these knowledge stocks, and in an appropriate acknowledgment of inputs from the intuitive processing system. All these issues are realizable within regular settings of vocational and professional education and training. Deliberate practice can be demanded by teachers who guide learners in establishing knowledge and experiences which allow the development of routines and automated action patterns. Gruber et al. (2008a) call such teachers the persons in the shadow and discuss their inevitable role for expertise development.

45.4.2 Mental Simulations

Klein (2003) introduces the concept of mental simulations as an additional procedure on how experts develop their performance capacities. Mental simulations do comprise and process not only factual experiences but also hypothetic experiences (i.e., speculations on what could happen under specific circumstances). By mentally running those thought experiments, experts develop general as well as domain-specific heuristics which do not require immediate conscious thought when needed in real application. Indeed, these processes are learnt and their enactment is premised on them not requiring recourse to conscious memory. Hence, experts mentally create difficult scenarios and think about possible solutions whenever they find

time to do so (e.g., firefighters on standby), and they judge their solutions and store them when considered as appropriate. Such activities can be considered as a kind of mental deliberate practice that Ericsson (2006) describes for chess grand masters who do the same when reanalyzing real matches. Experts, hence, are not satisfied with a current state of knowledge and routines for familiar situations; they permanently search for novel challenges and even create them mentally if they are not available in reality. Teachers in vocational and professional education and training can stimulate learners to thought experiments and reflections on their assumptions about possible outcomes of these experiments. This way, they can support learners to acknowledge the value of thought experiments, so that they can utilize them later for mental simulations.

45.4.3 Social Embedding into a Community of Peers

Experts do that best by integrating a community of experts that cultivates exchange and reviews of experience among peers (Berliner 2001; Gruber et al. 2008b). Though experts are characterized by extraordinary personal attributes (e.g., comprehensive knowledge, availabilities of routines, intuition), they still require sourcing for knowledge consolidation, generating meaning, and reviewing own experiences against peers. For the development as well as for the maintenance of expertise, the social embedding into a community of experts appears inevitable (Palonen et al. 2004). Within vocational and professional education and training, a social context for the discussion and development of knowledge can be established and provided. Learners can discuss their knowledge, mental models, and routines, in order to socially negotiate meaning and commonly shared knowledge stocks. As constructivists claim, applicable knowledge does not develop until its confirmation and proof in social negotiation. Additionally, teachers as persons in the shadow, as explained above, can implement the idea of cognitive apprenticeship (Collins et al. 1989) by supporting the learners to develop appropriate perspectives in their social negotiation processes.

45.5 Conclusions

Competence-based vocational and professional education and training focuses on the outcomes of pedagogical efforts. Such an orientation offers teachers and educational institutions opportunities to design their teaching independently from guidelines, as long they meet the defined outcomes. With regard to conclusions from the reflections on intuition as important component of professional competence and performance, two perspectives seem particularly striking: Since the importance of

intuition seems to be unchallenged from at least a theoretical viewpoint, it is firstly necessary to develop a concept on how best to support intuition within competence-based education and training. Secondly, in view of the problems of empirically grasping intuition, it is important to reflect challenges on how best to identify and certify learning success in developing intuition.

45.5.1 Teaching Intuition

The classical way of developing knowledge stocks which enable one to perform competently is described in various cognitive and expertise theories: The first step comprises the development of declarative knowledge (i.e., facts, terms, rules) and is a major part of conventional teaching within educational institutions. This initial declarative knowledge needs to be transferred to procedural knowledge which comprises experiences of applying declarative knowledge to concrete practical challenges. Repeated application of procedural knowledge to manifold contexts and the systematic reflection of experiences allow the development of scripts and schemata which become routinized and can be applied quickly to various situations. The final step of competence development then is that these routines can be applied without cognitive effort and awareness, but they need to be permanently refreshed and eventually updated. In the sections above deliberate practice, mental simulations, and social embedding were discussed in their opportunities for vocational and professional education and training. Literature provides various theoretical concepts describing the cognitive development involved in those activities: knowledge encapsulation (Schmidt and Boshuizen 1993), adaptive control of thought (Anderson 1982), deliberate practice (Ericsson 2006), and dynamic memory (Kolodner 1983). While modeling the cognitive activities differently, all these accounts share the idea that the reflection of learners' experiences of the application of their knowledge is the crucial activity for becoming and staying a high performer.

Eraut (1994) provided a review of literature on how best to support the development of professional expertise, and he concluded that declarative knowledge usually is learnt through instruction (through teachers as well as through handbooks) and is just one important contribution to professional expertise. Intuition and tacit knowledge make as well substantial contributions. Those are mainly developed outside educational or instructional interventions at workplaces and therein interaction with others, often those people who can contribute to a solution for a problem. This kind of learning occurs during work interaction, often as a result of enculturation and participation at work activities. In his chapter in this volume, Billett discusses practice-based learning through mimesis as a specific form of learning activity and work interaction. Common core of these accounts is the idea that learning occurs in context of daily work practices and that these learning activities necessarily require interaction with others – best those people with advanced knowledge and skills. Even though vocational and professional education and training might often occur within the setting of an educational institution, teaching can utilize characteristics

of workplace setting even within classrooms. It was already Resnick (1987), in her seminal paper on the comparison between learning in and out school almost 30 years ago, who suggested exactly that idea to design classrooms similar to workplace settings.

Klein (1997) calls his approach of teaching professional competence including tacit knowledge and intuition as naturalistic decision-making and refers to the idea to teach individuals firstly to think like experts. For this purpose, experts in a domain are to be interviewed about their thoughts and critical cues when solving challenging work problems in their domain. Crandall and Calderwood (1989) could exemplarily show that experienced nurses do not only search for hints documented in nursing handbooks when checking patients in neonatal intensive care but they also developed critical cues based on their experiences which enable them to do life-saving interventions in situations where scholastic criteria do not indicate scepsis. Klein claims to teach novices such critical clues and to provide them the explanation of experts as well, so that they learn to think like experts. This way, the development from novice to expert can be accelerated. This approach should also be applicable to settings of vocational and professional education and training.

In principle, these ideas of teaching intuition and expertise bridge the traditional distinction between vocational and occupational education as it was practiced in crafts and trades since centuries. The apprenticeship training model was based on the philosophy that students learned from masters, initially through observation and explanation, then gradually by working independently, and finally by going on the road for a certain period of time to learn different practices as well. Constructivist approaches of learning and instruction which were developed since the 1990s took such a view on learning too, such as the model of cognitive apprenticeship (Collins et al. 1989). Such learning settings differ from classical instructional approaches of classroom teaching. Competence-based education and training, hence, should acknowledge the importance of interaction with experts dealing with practical problems, if it aims at developing not only declarative knowledge but also competencies which comprise intuition and tacit knowledge.

45.5.2 Challenges

The realization of competence-based education and training as described above, however, reveals certain challenges. As the example of Crandall and Calderwood (1989) shows, it is necessary to modify the curricula through new input by experts. Such modification eventually requires complex negotiations with chambers of commerce or trade, and new content also needs to be integrated in time frames which may cause new (selection) problems. This all raises the typical problems of educational policy, particularly since competence-based education and training claims also to consider the demands of future work. Hence, a common view on future requirements and development needs to be negotiated on the one hand. On the other hand, it focuses on the assessment of the learning outcomes, too. It is particularly

the second point which raises unsolved challenges (which are addressed in the chapters of Van der Vleuten et al. and Blömeke).

As empirical studies on intuition reveal, it is methodologically still challenging to empirically grasp intuition (c.f. Sinclair 2014). This raises challenges, too. If competence-based education and training aims at the development of intuition, it becomes necessary to control learning success – firstly in order to prove the outcome quality of an educational intervention and secondly in order to acknowledge and certify learners' success. Intuition and tacit knowledge however cannot be standardized (which is emphasized in the chapter of Hyland), so that common approaches of operationalizing and testing learning success probably may fail. Computer simulations of challenging problems may be an appropriate and promising way for certain domains. However, perhaps it is necessary to abstain from testing learning success in such settings and to restrict certification to pure participation.

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Chapter 46
Labour Market Uncertainty and Career Perspectives: Competence in Entrepreneurship Courses

Olivier Toutain and Alain Fayolle

46.1 Introduction

Nowadays entrepreneurship is high on the agenda of many countries, and the number of entrepreneurship education initiatives is growing fast. Since the beginning of the third millennium, European Union institutions (European Commission 2003, 2009, 2010, 2013), OECD (2010) and national governments across the European Union have become increasingly involved in entrepreneurship education. The various schemes and initiatives address primarily two broad objectives, on the one hand, supporting new business start-ups and, on the other hand, developing an entrepreneurial mindset in society (and among the young in particular). For example, an international survey conducted by the European Commission shows that 87% of European higher education institutions and universities offer entrepreneurship education programmes (European Commission 2008a).

Thus, expectations towards entrepreneurship are gaining momentum in Western societies and mostly revolve around two broad issues: (1) How to increase the number of start-ups in order to strengthen the creation of economic wealth and social value? (2) How to educate and train people in order (a) to foster entrepreneurial attitudes and behaviours, (b) to develop the type of skills necessary to start and develop business projects and (c) to develop adaptation mechanisms to cope with an uncertain and unpredictable world?

Since the Lisbon European agreements (Convention on the Recognition of Qualifications concerning Higher Education in the European Region 1997 – enforced as of 1 February 1999) some 15 years ago, many entrepreneurship

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education programmes have emerged (Eurydice 2012). However, empirical studies have yet to identify clearly what entrepreneurial competencies are targeted by these programmes, which leads us to ponder how these competencies are defined and, above all, who designs and teaches these entrepreneurship education programmes.

Most current scientific studies concerned with entrepreneurial competencies focus on their role in business start-up and growth, and so far they have failed to yield consensual results or a coherent taxonomy of expected competencies (Mitchelmore and Rowley 2010).

In the field of entrepreneurship education, teaching programmes are developed based on criteria that relate to four main questions (Fayolle and Gailly 2008): (1) What types of courses will the programme include (disciplines, contents)? (2) How will entrepreneurship be taught (pedagogical tools and methods)? (3) What learner profile is targeted (discipline, age, psychological profile, background and experience in entrepreneurship)? (4) Why and for what outcomes is entrepreneurship taught (objectives and evaluation)? Most studies suggest that higher education entrepreneurship programmes are widely influenced by cognitivist and socio-cognitivist theories (Byrne et al. 2014). Therefore, pedagogies used often include experiential learning, learning-by-doing, serious games, case studies, problem-based learning and project development. However, despite the contributions of the aforementioned studies, the field still lacks a clear understanding of the competencies developed in these courses.

In addition, the vast majority of available research is undertaken mostly within the context of higher education, due to the proximity between researchers and the education ecosystems of the universities and colleges in which they work (Ruskovaara 2014).

Finally, introducing entrepreneurship education in vocational training institutions is still a recent phenomenon, despite long-standing recommendations (Gibb 1996).

Consequently, as we will see in this chapter, the definition of entrepreneurial competencies in vocational and professional education stems in large part from scientific research conducted in the context of higher education. Reviewing the definition of entrepreneurial competencies raises questions (related to the learning object, the nature of the learning context, the teacher's profile and the pedagogies implemented) that extend beyond specific teaching contexts and that concern all teachers involved in entrepreneurship education.

While the entrepreneurial competencies expected in schools relate more to the development of entrepreneurial attitudes and behaviours than to starting a business, expectations in vocational training centres involve a combination of entrepreneurial attitudes, behaviours and technical skills with a view to starting a new business (Ruskovaara 2014).

This chapter constantly moves back and forth between the learning contexts of vocational and professional (higher) education. The various sections should therefore be considered as being addressed primarily to researchers and teachers, as well as school heads of education and teachers and vocational training institutions.

We will first present a state-of-the-art review of entrepreneurship education today. We will examine more particularly how entrepreneurship education is discussed among the academic community. We will thus show how the entrepreneurship learning process and, as a result, expected competencies are defined by a complex interaction between the teacher, the learning object and the environment.

In the second part of this chapter, we will discuss future trends in entrepreneurship education and expected competencies in higher education and vocational institutions. The increasing individualisation of training programmes, in which learners have to take responsibility for what they learn, the growing professional mobility and the need for lifelong education lead to the transformation of the learner into an entrepreneur from an ever-earlier age, an entrepreneurial posture that is highly valued among recruiters and institutions. According to scholars, the success of the twenty-first-century education relies on the capacity of schools and vocational training centres to help learners acquire entrepreneurial competencies, which require them to take control and self-direct their own learning process. Self-directing one's learning process implies the development of meta-competencies, which enable learners to act in contexts of uncertainty and unpredictability. The type of competencies expected in this approach to learning mostly relates to the acquisition of soft skills, such as autonomy, creativity, calculated risk-taking, cooperation and adaptation to the environment.

46.2 What Do We Know About Entrepreneurship Education and Entrepreneurial Competencies?

Entrepreneurship as a discipline has its roots outside of school, in processes of human action that create economic, social or cultural value, driven by the will to develop projects.

As we will see in this section, targeted competencies differ depending on:

(1) The learner's personal commitment (or the degree of student freedom and control in the learning process)
(2) The learning object (new business start-ups or the transformation of the individual through the acquisition of an entrepreneurial mindset and behaviour)
(3) The learning environment (nature of the learning ecosystem moving back and forth between the classroom and a strong connection with the real world, with partnerships and outside experiences)
(4) The role of the teacher (source of knowledge, facilitator and/or coach)

The three elements of any education scheme (the learning object, the environment and the teacher) interact with the learner who, as a result, acquires technical or behavioural competencies, with more or less freedom depending on whether the

approach is prescriptive (acquisition of technical knowledge, execution of tasks) or open-ended (learning how to act) (Le Boterf 2013; Toutain 2008, 2010). These competencies then influence the transformation of the learner's behaviour, cognition and knowledge (Toutain 2010).

The rapid expansion of entrepreneurship in higher education and vocational training institutions goes hand in hand with a great diversity in the way that programmes are developed and taught and how objectives are defined (Béchard and Grégoire 2005; Rizza and Varum 2011). These initiatives respond generally to a need, which consists in training students to start and grow businesses or to develop an entrepreneurial mindset, which implies developing a general attitude that can be of use in any personal and/or professional experience. These two didactic definitions relate to the acquisition of different competencies. The first type of competence relates to the kind of know-how necessary to start up and develop a business, whereas the second one relates more to knowing 'how to act entrepreneurially' (Fig. 46.1).

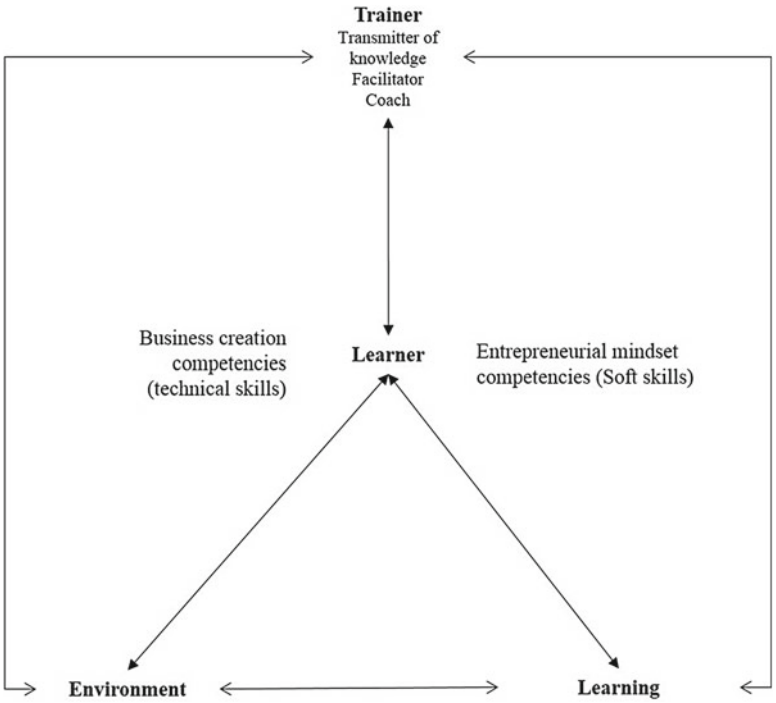

Fig. 46.1 Process of acquiring entrepreneurial competencies

46.2.1 The Learning Object

46.2.1.1 Competencies Related to New Business Start-Up

As mentioned above, some entrepreneurship teaching programmes focus on training individuals to become entrepreneurs and start their own business. Skills such as networking, developing business plans and business models, managing financial and human resources, devising a marketing strategy or even choosing between different legal and fiscal business forms are all useful for turning learners' projects into reality. In this context, education programmes are mostly focused on acquiring and developing skills as well as engaging with a network of potential partners linked to business start-up and management. The acquisition of expertise and technical skills is therefore essential in order to enable individuals to set up their own business and thus become entrepreneurs, and knowledge transfer is the predominant approach. The mission of the school or university is to impart a determined set of skills and 'truths' rather than to educate. This approach to learning is more particularly associated with the French educational model as championed by Durkheim (Behrent 2014). For the French sociologist, education goes hand in hand with method and rigour, whereby individuals are trained to think critically and reason based on a proven body of knowledge. According to this 'teaching paradigm', the learner is expected to read, use deductive reasoning, provide logical and rational argumentation and display well-structured thinking (Barr and Tagg 1995) with particular reference to business start-up and development.

46.2.1.2 Competencies Related to an Entrepreneurial Mindset

In the second type of entrepreneurship education initiatives, courses aim at training students to develop an entrepreneurial mindset, which can be defined as the acquisition of a dynamic set of attitudes, values and cross-disciplinary competencies. In this case, learning relies mostly on the acquisition of soft skills, including abilities and attitudes such as motivation, self-confidence, adaptability to uncertain environments, identification of resources in the environment, risk evaluation, creativity, projection, empowerment, leadership, teamwork or even self-reflection. Learners are encouraged by teachers to be proactive. Specific competencies expected thus include the identification of opportunities and the development of realistic innovative projects, the ad hoc commitment and management of resources, as well as selling the business concept. In this paradigm, the role of the teacher is to help transform learners (Mezirow 1997) in order for them to acquire these competencies, which requires time and appropriate mentoring. Transformation here refers to the way learners transform experience into learning, by changing their ways of acting and of viewing the world and also by changing their frames of reference. In other words, it is the whole process by which knowledge is created that is transformed (Harrison

and Leitch 2005). The theoretical underpinning of this approach to learning stems from Dewey's founding work (Dewey 2012). In this model, schools and universities tend to educate through feeling and experience, which means that individuals learn by making sense of their everyday experience. The concept of entrepreneurial education thus takes on its full meaning, what Barr and Tagg term the 'learning paradigm', as opposed to the 'teaching paradigm' (Barr and Tagg 1995).

46.2.1.3 Competencies Related to Didactic Models

The two didactic models presented above define different approaches to teaching entrepreneurship. Yet, didactic objectives are rarely addressed before pedagogical approaches are determined (Byrne et al. 2014; Naia et al. 2014). Most publications in the scientific literature discuss methods for teaching entrepreneurship without explicitly addressing the link between the didactic objectives and the methods examined, which makes them difficult to compare objectively (Blenker et al. 2011). In order to see through this diversity of practices, Béchard and Grégoire (2005) suggest using Bertrand's typology (Bertrand 1995) of the four main components of contemporary theories of education: (1) the contents of education, (2) the interaction between education and society, (3) person-centred approaches 'personalist approaches' (personalist theory) and (4) interactionist approaches (psychocognitive, sociocognitive and technological).

From an academic perspective, Honig (2004) and Neck and Greene (2011) suggest that schools, universities and students in entrepreneurship first define the way they view entrepreneurship education. Fayolle and Gailly (2008) propose a conceptual framework incorporating two complementary levels of analysis (ontological and educational). The ontological level relates to the following questions: What does entrepreneurship education mean? What does education mean in the context of entrepreneurship? What are the respective roles of educators and participants? Fayolle explores the question further and suggests three strategies for the future development of entrepreneurship education (Fayolle 2013): (1) target entrepreneurship education by incorporating entrepreneurial culture, reasoning, action, method and *bricolage* (tinkering) in order to enable participants to think, act and make decisions in a wide range of situations and contexts; (2) connect entrepreneurship teaching with other disciplines (more especially with education science) and real-life entrepreneurial action as experienced by entrepreneurs themselves (more particularly with regard to how they solve problems); and (3) adopt a systematically critical and reflexive approach to scientific and academic knowledge (from different disciplines) and the different initiatives in entrepreneurship education.

From a more pragmatic perspective, Blenker et al. (2011) suggest connecting the 'what', the 'why' and the 'how' by asking educators and teachers to answer one or more of the following questions (which they should have previously selected): How do you train individuals (1) to start new ventures? (2) to create high-growth firms?

(3) to solve a large range of societal issues, by thinking and acting entrepreneurially? and (4) to develop an entrepreneurial mindset?

In short, the learning object is above all determined by the didactic goal of entrepreneurship education (the 'why'), which translates primarily into two complementary visions of teaching and entrepreneurship: learning how to start and develop a business and developing an entrepreneurial mindset. In the first case, the acquisition of technical entrepreneurial competencies is critical, whereas in the second case, the focus is on developing soft skills. Depending on the didactic approach selected, teachers will opt for different teaching strategies. The acquisition of technical skills relies more on prescriptive tasks (students mobilise knowledge to solve specific problems), whereas the development of the soft skills necessary to develop an entrepreneurial mindset requires students to show initiative and to be creative, cooperative and autonomous in order to find solutions (which are not determined at the outset).

46.2.2 The Environment

The environment plays a key role in the success of pedagogical practices and the individual's self-development throughout the learning process: it is a key resource for learning and a collective construction of competencies.

46.2.2.1 The Environment: A Key Resource for Learning

The learner's environment is composed of the people at school, members of their family circle and more generally members of their social networks. The influence of the environment in the learning process has been widely studied in education science, most notable in the latter half of the twentieth century by Vygotsky and Piaget. According to Vygotsky, the members of the learner's social networks (primarily the teacher) play a key role in the development of the learner's knowledge (Vygotsky 2012). With the concept of 'zone of proximal development' (refers to what tasks a child (or a student) can perform when given appropriate help or guidance), Vygotsky insists on the role of social mediation in the individual's learning process. In other terms, the people who interact with the learner play an important role as regulators of the learning process: they facilitate the acquisition of competencies by the individual. As for Piaget, an individual learns from interacting with his or her environment and thanks to what he called the 'progressive equilibration' process, whereby the individual acquires the necessary competencies (Piaget 1975). In other words, when a learner does not possess the required knowledge to solve a problem, he or she finds himself or herself in an uncomfortable situation that Piaget defines as 'cognitive disequilibrium'. The learner thus strives to re-establish equilibrium by

interacting with the actors in his or her environment in order to find a solution to his or her initial problem; the solution is therefore a source of new knowledge. The learner thus finds himself or herself once more in a state of cognitive equilibrium; this is what Piaget calls the 'progressive equilibration' process (Toutain 2010).

In the field of entrepreneurship education, the nature of expected competencies also determines how much freedom of action the learner has. If the expected competence is of a technical nature (for instance, how to draw up a financial statement), there will be fewer interactions between the learner and the various actors in the environment, and the mediating role therefore lies mostly with the teacher. However, if the expected outcomes are the generation of new creative ideas, learners will find themselves in a more open-ended learning process (less constrained by resolution rules) in which interactions with the environment and the educator will play a greater role. Pedagogical practices are also determined by the degree of openness of the learning process: open-ended processes will tend to rely mostly on active pedagogies and learning-by-doing, whereas prescriptive or closed approaches will rely more on transmissive pedagogies.

46.2.2.2 A Collective Construction of Competencies

It is widely acknowledged among scholars, and more especially in the French education science literature, that the environment plays a significant role in the construction of competencies (Bain 2002; Bellier 2000; Le Boterf 2013; Durand 2006; Gorz 2001; Oiry 2005; Perrenoud 2002; Rey 1996; Stroobants 2002; Zarifian 2004). The learning process thus generates a double transformation: that of the learner who acquires new knowledge in order to solve the problems encountered (e.g. locating information regarding financial aids to set up an innovative business) and that of the environment, whose actors also acquire new knowledge (e.g. the launch of a new innovative business). Interaction between the learner and the environment thus produces mutually reflexive outcomes for the learner and the members of his or her environment.

By taking initiatives, the learners contribute to the construction of a collective form of competence, based on the sharing – active or passive – of experiences. Le Boterf (2013) speaks of a 'shared environmental resource', an expression borrowed from the field of ergonomics.

In order to solve problems in complex entrepreneurial situations, learners are encouraged to acquire the necessary skills to act collectively and learn how to combine the resources present in the environment in order to obtain the knowledge they need (Toutain 2007). Consequently, competencies are constructed, developed and tested through action (Bellier 2000), which translates rather well the idea of 'doing in order to understand, and understanding in order to do' (Avenier 2000). In this context, expected competencies are the result of a socio-constructivist (Löbler 2006) and collectivist vision of the entrepreneurial process (Jones and Spicer 2009).

This constructivist approach requires educators and heads of programmes in entrepreneurship education to develop and utilise the entrepreneurial ecosystem by creating close collaboration networks (Tuunainen 2005), thus transforming their schools or universities into entrepreneurial universities (Clark 2001). The entrepreneurship education ecosystem, which influences the nature of the expected competencies (open-ended or closed/prescriptive competencies, related to knowledge, know-how or knowing how to be), can be defined by five dimensions (Mueller et al. 2014; Toutain et al. 2014a: the type of entrepreneurship programme (focused on developing creativity and transversal knowledge/technical knowledge), the nature of the networks developed (inside and outside the school context), the dedicated learning space (open and collaborative/closed and individual), the type of entrepreneurial culture targeted (business management/entrepreneurial mindset) and the pedagogical solutions adopted (transmission learning/experiential learning).

In short, the actors of the environment are stakeholders of the entrepreneurial learning process. If the object of learning is to acquire the technical knowledge necessary to set up a business, then interaction with actors in and out of the school will be limited and the teacher will be at the core of the learning process. This approach relates closely to an instructional (transmissive) model of education. However, if the aim of the training programme is to acquire an entrepreneurial mindset or study the feasibility of a project, the learning process is more open. In this case, learners will maximise interactions with the actors in their environment, which leads to a more collective competence-building process: learners and actors of the environment collaborate in order to find solutions to the problems they encounter. Finally, the effectiveness of the role played by environmental actors also depends on the education ecosystem involved: the more open-ended the learning approach (for instance, if geared towards acquiring an entrepreneurial mindset), the more determinant the quality of the education ecosystem in order to help the learner acquire useful soft skills.

46.2.3 The Educator

The teacher plays a crucial role in teaching entrepreneurship education. Its role varies from the one who transmits knowledge to the facilitator who guides the learner. Beyond this role we know very little about who teaches entrepreneurship (subsection 1) and what is their profile (subsection 2).

46.2.3.1 Who Teaches Entrepreneurship?

Entrepreneurship teaching programmes have developed exponentially in higher education, more particularly in schools of management. For example, a recent international survey of entrepreneurship in higher education institutions shows that 87%

of European higher education institutions (schools and universities) offer courses or programmes in entrepreneurship (European Commission 2008a).

Although still in an early phase, the phenomenon is also spreading across vocational training institutions. In Europe, between 3 and 4% of primary schools, 11% of secondary schools and 15% of vocational training centres have taken initiatives towards developing an entrepreneurial mindset.

Given the objectives defined by such international institutions as the European Union (European Commission 2012, 2013), the trend is likely to consolidate over the next decade. This evolution leads researchers to examine the nature of entrepreneurship education programmes that are being developed in European schools. In this regard, Byrne et al. (2014) and Naia et al. (2014) show that most extant research focuses on what to teach in entrepreneurship, how (with what kind of activities or methods) and/or for what results (impact studies). However, there is, first of all, a lack of understanding about why we should teach entrepreneurship (objectives are often too general and lack substance), and the issue of 'who' teaches entrepreneurship is not addressed. Indeed, other than the fact that they are teachers, we know very little about the profiles of the individuals who teach entrepreneurship (Fayolle 2013; Löbler 2006). Aside from a recent study on entrepreneurship teacher profiles in primary and secondary schools (Ruskovaara 2014), most research on entrepreneurial competencies is student focused (Hynes and Richardson 2007). Yet, if we are to understand the didactic objectives and training methods used in entrepreneurship education, we also need to understand better the profiles of entrepreneurship educators and teachers, the way they view entrepreneurship and how they define entrepreneurship education.

46.2.3.2 A Profile of the Entrepreneurship Teacher

Current research in entrepreneurship education (Mueller et al. 2014; Raucent et al. 2003; Surlemont et al. 2009; Toutain 2010; Toutain et al. 2014a, b) is more focused on the expected profile of entrepreneurship educators than on examining the actual profiles of teachers in entrepreneurship. The present dominance of constructivist and socio-constructivist approaches in entrepreneurship teaching has led researchers to draw the following profile of the typical entrepreneurship teacher, who (1) possesses both teaching and entrepreneurial experience, (2) has skills in leadership and team management, (3) develops networks in and outside the school and (4) acts more as a coach and facilitator than as a transmitter of knowledge. Besides the characteristics listed above, it is important to note that heads of entrepreneurship programmes may sometimes be perceived as dissidents in standardised educational systems (Mueller et al. 2014).

The profile of the entrepreneurship teacher is mostly defined with regard to that of the higher education teacher (Ruskovaara 2014). According to the European Commission (2008b), the ideal teacher in entrepreneurship possesses both entrepreneurial and academic experience and knows how to connect both worlds in his or

her entrepreneurship programme. When teachers do not possess first-hand entrepreneurial experience, inviting real-life entrepreneurs as contributors is indispensable.

Consequently, teachers who have extensive entrepreneurial and academic experience will tend to adopt a more socio-constructivist approach, and students will be encouraged to take risks in contexts of uncertainty and *bricolage*. The role of the teacher is thus one of facilitator and coach, while students are handed over control of their own learning process. As a result, a teacher's prior academic and entrepreneurial experience impacts more strongly his or her vision of entrepreneurship education than other criteria such as age, gender and discipline (Ruskovaara 2014).

Due to the recent emergence of entrepreneurship awareness programmes in schools across Europe, there is no available study on *who* teaches entrepreneurship. However, early analysis of the data collected by the 'Entrepreneurship 360°' programme (under joint management of the OECD and the European Union; OECD and European Commission 2014) shows that two profiles of entrepreneurship teachers seem to coexist. One profile is that of the school teacher, whose intervention is transversal across the school curriculum through entrepreneurship teaching, and the second profile is that of an outside actor (member of an association or an institution or a business owner) who uses his or her social network to connect with and intervene in the school. In most cases, both join forces to offer entrepreneurial programmes inside and outside of the school. More generally, this joint initiative of the OECD and the European Union aims at providing schools with reflective tools in order to help them develop entrepreneurship awareness and identify internal and external actors who may take on a leadership role in meeting these objectives. In other words, teachers and heads of programmes who do not possess the necessary entrepreneurial experience tend to use resources – notably human – from outside the school, by engaging the help of entrepreneurs and organisations who work hand in hand with them.

To sum up, no study has yet closely looked into who is in charge of teaching or managing entrepreneurship courses. The available body of knowledge is mostly limited to the expected or ideal profiles of entrepreneurship teachers, which are mostly developed based on constructivist and socio-constructivist approaches. The ideal type of entrepreneurship teacher in higher education consists in being more of a facilitator, a leader, a creative entrepreneur and a network developer. While 15% of vocational training institutions in Europe propose entrepreneurship courses, primary and secondary schools remain far less concerned by entrepreneurship education. However, the early data collected on a European scale seems to show that entrepreneurship education should involve a great diversity of teacher profiles, ranging from the traditional teacher to the visiting entrepreneur.

46.3 What's Next? Towards Entrepreneurial Competencies Based on Uncertainty and Self-Regulated Learning

The entrepreneur is at the heart of the phenomenon. He/she evolves in a socio-economic environment in order to create and develop new economic and social wealth. This environment is constantly changing. This allows the entrepreneur to permanently adapt his/her decisions and actions to the changes without predicting the future. In this context, the core issue in entrepreneurship education is (1) to acquire competencies based on the management of uncertainty (subsection 1) and (2) to self-regulate learning (subsection 2).

46.3.1 Dealing with Uncertainty

In the first – and only – special issue devoted to 'entrepreneurial learning' (July 2005), Harrison and Leitch (2005) start by writing that 'It is important to recognize that there is a fundamental distinction to be drawn between knowledge – that which is known, and learning – the process by which knowledge is generated'.

The dominant approach in schools and vocational training centres consists in raising cultural awareness of entrepreneurship and developing an entrepreneurial mindset in individuals, an outcome which is strongly supported by national and international institutions (European Commission 2013; OECD 2010). Among the four strategic objectives defined by the framework for European cooperation in education and training, European leaders emphasise the necessity to 'enhance creativity and innovation, including entrepreneurship, at all levels of education and training' (European Commission 2009).

Fostering an entrepreneurial mindset in individuals extends the vision of the entrepreneurial process beyond the traditional notion of business start-up. Creating entrepreneurial mindsets implies encouraging the development of entrepreneurial behaviours and attitudes and, more specifically, the development of skills such as autonomy, responsibility, creativity, cooperation, adaptation to uncertainty and unpredictability. In other words, it is about training *antifragile* individuals (Taleb 2013), who are capable of creating opportunities by identifying and utilising human, material and financial resources from the environment. This trend illustrates a strong demand in a society forced to look for new socio-economic paradigms and innovative solutions to an economy deadlocked in a never-ending cycle of exponential growth.

In the research field, the theory of effectuation (Sarasvathy 2001, 2008; Sarasvathy and Venkataraman 2011) has largely contributed to a renewed understanding of the entrepreneurial process by breaking away from the positivist scientific reasoning approach. According to the theory of effectuation, entrepreneurship should no longer be regarded as a process of planned actions in a predictable future but as a journey during which the individual develops his or her entrepreneurial project by using the resources he or she can identify. In other words, the individual

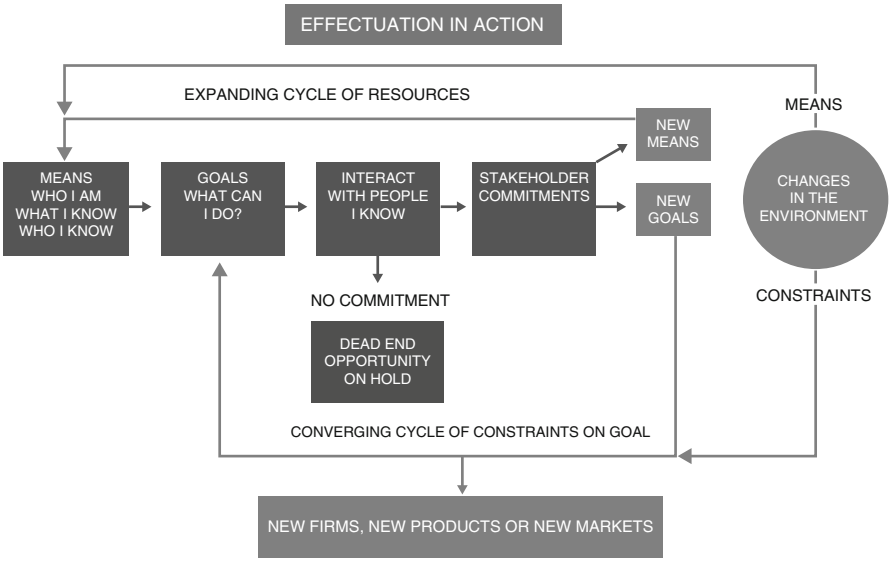

Fig. 46.2 Effectuation in action (The Society for Effectual Action (SEA) 2012)

progressively becomes an entrepreneur and develops his or her project according to the various opportunities present in the environment.

This approach, which has gained considerable popularity in the field of academic research over the past decade, invites teachers as well as the heads of educational programmes to challenge the positivist view of traditional education based on knowledge transmission. It is a priority to develop effectual reasoning skills in learners, to enable them to act in uncertain and unpredictable environments. The acquisition of these skills requires that the learners ask the following questions: (1) Who are they and what do they know? (2) What can they do? (3) Who are the stakeholders (inside and outside the school) that they can interact with? (4) What stakeholders they may engage with in order to progress? Interactions with stakeholders lead to the emergence of new means and new objectives, which in turn expand the learner's scope of learning (Fig. 46.2).

Reasoning effectually in order to develop one's entrepreneurial mindset is not a natural behaviour. In order to adopt an effectual mode of thinking, learners need to be motivated, to be in control of their learning and to feel self-efficacious in the execution of tasks. In education science, motivation, self-regulation and self-efficacy are defined by scholars as the three key elements of self-directed learning.

As will be shown in the following section, self-directed learning requires the development of skills in order for the learner to adopt effectual thinking with a view to acquiring an entrepreneurial mindset.

The three key elements of self-directed learning provide a framework for structuring entrepreneurship education programmes and expected entrepreneurial competencies, based on the acquisition of soft skills.

46.3.2 Entrepreneurial Competencies Gained Through Self-Directed Learning

46.3.2.1 Origins of Self-Directed Learning

Self-directed learning emerged in the 1970s. Its epistemological characteristics stem from cognitivist, constructivist and socio-constructivist theories in the field of education science. Self-directed learning is closely related to the foundational work of Dewey (2012), Piaget (1975) and Vygotsky (2012) and to the innovative pedagogies developed by Montessori (2012), Claparède and Avanzini (2003), Freinet (1993), Steiner and Bamford (1996) or Rogers (1969).

This type of learning relies on the initial belief that 'an adult is only willing to commit to a training programme if it responds to his or her needs and problems, in his or her situation' (Schwartz 1989). Therefore, what enables learners to take control of their learning process lies in their motivation, their capacity for action and for making sense of and giving a direction to the process. Self-directed learning also requires learners to mobilise and develop capacities to direct an 'intentional mental process' and perform 'behavioural activities', more particularly as regards the search for information (Long 1991). This learning approach thus clearly moves away from the more traditional, transmission-based, learning models. Learners are encouraged to 'train themselves': 'the key competence in the social subjects who are expected to become lifelong learners is self-direction' (Carré 2010). The cognitive and behavioural dispositions expected in learners are therefore very close to the abilities expected from entrepreneurs in order to act and adapt to uncertain and unpredictable contexts. Self-direction is the key competence to be acquired here, and it transforms the representations of education into a permanent activity, continuing throughout the learner's life.

46.3.2.2 The Three Key Elements of Self-Directed Learning

Self-directed learning relies on three key elements: self-determination, self-regulation and self-efficacy.

- Self-determination

Self-determination can be defined as the feeling, for an individual 'to be free to act, to be free to choose one's actions, to be proactive, that is to say to feel like the author of one's decisions and one's actions' (Carré 2010). The- degree of motivation in learning is therefore closely related to the feeling one has of progressing on one's own, which translates into the progression from one anterior state towards another state, deemed 'superior' (Nuttin 1980). This vision of learning is in particular based on Piaget's theory of progressing equilibration (Piaget 1975) and has been modelled to explore entrepreneurship experiential learning process (Toutain 2010).

Self-determination is key to effective self-directed learning (see the chapter of Nokelainen in this volume). However, self-regulation varies depending on the train-

ing context and the learning process involved. Drawing on existing research, more particularly that of Deci and Ryan (Deci and Ryan 2000), Carré- shows that it evolves along a continuum involving four regulatory processes (Carré 2010): controlled extrinsic motivation (for instance, the employee who engages in a training programme at the request of his or her employer), introjected extrinsic motivation (for instance, an adult who goes into training, because he or she knows he or she has to do it), identified extrinsic motivation (the learner acts on behalf of his or her personal beliefs) and, finally, integrated extrinsic motivation (the learner is fully aware of his or her freedom of choice).

Thus, the characteristics of entrepreneurship training programmes and how free the learner is to engage them in and commit to the learning process constitute the main variables that influence the intensity of the learner's motivation at the outset, but more especially its persistence over time. Indeed, initial motivation may erode if it is not supported by abilities to self-regulate the learning process. The situation is comparable, for instance, to an individual taking up a new sport. The issue of the 'maintenance' of the motivation through the learning process has been extensively studied, for example, by anthropologists Bateson and Mead (Bateson 2000).

- Self-regulation

Self-regulation is another determinant dimension of self-directed learning – 'all learners are eventually faced with a dual problem: setting down to work and sustaining their effort' (Cosnefroy 2011). Self-regulation is thus defined by the capacity of the learner to maintain his or her motivation and commitment throughout the training process.

Consequently, learners are encouraged to develop learning strategies. The ability to self-regulate their learning process – and see it through – is therefore linked to their initial motivation for learning. The opposite is also true: good self-regulation fuels the learner's motivation to persevere in the learning process. Therefore, self-determination (motivation) and self-regulation interact closely.

In his review of the literature from the past twenty years, Cosnefroy identifies three types of self-regulatory strategies (Cosnefroy 2011): (1) cognitive and metacognitive strategies (the ability to learn how to learn), (2) volitional strategies (maintenance over time of the will to learn) and (3) defensive strategies aimed at protecting one's self-esteem.

Thus, self-regulation requires the development of internal monitoring and adjusting of one's affective and cognitive states and of behavioural know-how (or the acquisition of self-learning techniques such as repeating aloud or self-interrogation).

Despite apparent proximity, self-regulation and self-direction are fundamentally distinct. While self-directed learners are very autonomous in their choices and the definition of their learning objectives, some learners may also be led to develop self-regulating abilities by performing tasks despite not having chosen freely their training programme or their learning objectives (which are in this case defined by the teacher). Consequently, a learner's ability for self-regulation is not enough to support self-directed learning.

- Self-efficacy

If motivation relates to satisfaction and self-regulation to strategy planning, self-efficacy relates to learners' beliefs in their own abilities to perform actions towards the attainment of a given goal. Self-efficacy is therefore closely related to the notion of 'competence', which results from 'the successful undertaking of projects, activities and/or meaningful tasks-' (Carré 2010).

Self-efficacy therefore requires the construction of a positive self-image, dialogically related to self-determination and self-regulation: a feeling of satisfaction enhances one's positive self-image. Thus, the ability to successfully self-regulate one's learning process reinforces one's feeling of self-efficacy, in the same way that the successful self-regulation of one's learning process, combined with strong motivation, positively impacts one's self-esteem, and therefore the feeling that one is competent.

The combination of self-determination, self-regulation and self-efficacy thus promotes what philosopher Paul Ricoeur calls 'agentivity', in other words, 'one person's power to act' (Ricoeur 1995). However, the agent is not isolated socially but self-directs his or her learning by interacting with the various resources present in the environment. The agent is thus a social subject (Bandura 1997), who depends on the context in which he or she acts, as co-producer of his or her knowledge, just like an entrepreneur in action (Jones and Spicer 2009). In other words, 'self-directed learners show initiative, independence and persistence in learning; they take responsibility for their own learning and consider problems as challenges, not obstacles; self-directed learners are capable of self-discipline and display a high level of curiosity; they have self-confidence and a strong desire to change; they are willing to apply their studying skills to organising their time and pacing themselves, and to make plans to successfully complete their work; self-directed learners are individuals who love to learn and tend to be goal-oriented' (Guglielmino 1977).

In self-directed learning, individuals are considered as social actors who show initiative and interact with their environment. The values underpinning this approach respond to society's expectations in a context of socio-economic change, uncertainty and unpredictability. Moreover, it is consistent with the principles of effectuation theory.

The development of entrepreneurship education programmes inspired by self-directed learning offers a tremendous opportunity to help students transform into enterprising individuals and/or entrepreneurs. Project-based pedagogies, learning-by-doing and problem-based learning within an effectual framework can provide an 'autonomy-supportive' learning environment (Reeve et al. 2008), conducive to self-directed learning. Self-directed learning is also key in helping learners acquire the meta-competencies required to develop an entrepreneurial mindset and learn how to negotiate their way through life in an uncertain and challenging environment.

To sum up, training individuals to acquire an entrepreneurial mindset in schools and vocational training centres leads teachers and programme managers to invent new, more transversal, ways of learning. These new principles challenge the tradition of transmission teaching based on the positivist paradigm of knowledge trans-

fer. Applied to the world of education, the theory of effectuation offers a new framework for action in order to help learners acquire entrepreneurial competencies such as autonomy, risk-taking, creativity, cooperation and the ability to adapt to an uncertain and unpredictable future. In these conditions, learners need to acquire second-order competencies (or meta-competencies), the acquisition of which is strongly related to a motivated and sustained commitment to learning, as well as the self-control of one's learning process. More generally, these entrepreneurial meta-competencies impact positively the feeling of being competent to act in situations of great uncertainty.

46.4 Conclusions

This chapter was written with two objectives in mind: (1) to present an overview of current entrepreneurship teaching approaches and expected competencies and (2) to propose a reflective framework for programme managers and educators based on emergent theoretical and pedagogical concepts in the field of entrepreneurship education. Most studies concerned with the notion of entrepreneurship competencies are conducted in the context of higher education, which means that defining expected competencies in vocational training institutions represents a new field of investigation. As a result, entrepreneurship teachers, researchers and institutional actors are encouraged to expand the field of study beyond the limits of higher education. This chapter is a contribution in this direction.

We first presented an overview of entrepreneurship education. We then showed that the competencies expected from entrepreneurial education programmes revolve around two main objectives: (1) the creation and development of new businesses and (2) the acquisition of an entrepreneurial mindset. We also underlined the fact that the entrepreneurial learning process is a complex endeavour, which requires the interaction between three key components: the teacher, the learning object (start-up/development of a new business or development of an entrepreneurial mindset) and the environment.

Entrepreneurship education is not yet widely developed in vocational training institutions (Gibb 1996; Ruskovaara 2014). However, the situation is likely to evolve rapidly in the next few years, as some countries like Finland, Sweden and Denmark, other member states of the European Union and the OECD are committed to promoting entrepreneurship education, with particular regard to the development of an entrepreneurial mindset. Besides the use of active pedagogies that place learners in situations in which they can/must act, this approach of entrepreneurship learning encourages researchers and practitioners to invent new frameworks for action, moving away from the more traditional knowledge transmission approaches. With this in mind, we have suggested using a new educational approach based on effectual reasoning as a framework for action. Effectual reasoning relates to the way one views – and acts in – the environment while accepting uncertainty and the necessity to adapt to constant change. In support of this framework, we also high-

lighted the need for learners to acquire meta-competencies in order to self-direct their own learning process. The teacher and the teaching methods used play a significant role in helping the learner to take control of his or her learning process. They are also key in enabling the learner to develop his or her sense of competence in order to become autonomous, creative, responsible and cooperative, to take calculated risks and, more generally, to act confidently in uncertain and challenging situations.

In this chapter, we have presented some key elements for guiding reflection on expected entrepreneurial competencies, based on the following questions:

- What is the objective of the entrepreneurship training programme? Learning how to set up a business or developing an entrepreneurial mindset.?
- What is the teaching approach? A 'closed' (prescriptive) pedagogical approach (mostly based on the acquisition of technical competencies) or an 'open' approach (based on the transformation of the individual)?
- What is the framework for action? A strictly scheduled and predetermined framework or one based on uncertainty and unpredictability?
- How much freedom do learners have regarding their learning process? Is there little room for self-direction (the teacher sets constraints on how tasks are to be performed), or is it mostly self-directed (great freedom is given regarding the learner's choices and learning objectives)?

The answers to these questions define the type of entrepreneurial competencies targeted. They fall into two broad categories: technical competencies, based on a positivist paradigm of knowledge transmission, or soft skills, based on a constructivist and socio-constructivist approach. An appropriate definition of these competences related to the specific context, teacher's profiles and practices are key in making entrepreneurship education become a recognised discipline and consolidating the respectability of teachers, schools, parents and, most of all, students. To this end, in addition to a better definition of expected competencies, it is also important to check that pedagogical innovations, programme contents and target objectives are in line with the field of entrepreneurship teaching (Kuratko 2005).

The current demand from institutions to train students to act entrepreneurially in a society forced to invent new socio-economic paradigms (hence the need for entrepreneurial competencies) is one of the foremost educational challenges of the next decade.

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Chapter 47
Becoming Globally Competent through Student Mobility

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47.1 Introduction

One of the basic requirements for education nowadays is to prepare learners for participation in a networked, informational, and increasingly virtualized society. The ability to productively collaborate across cultures, distances, and various contexts will be one the most critical resources for social and economic development. At least three prominent driving forces of this are (1) the globalization of the economy with increasing mobility of labor (the unprecedented vast and rapid movement of people, ideas, and goods across the globe), (2) advances in computer and information technology that have brought new opportunities to connect people across physical distance and time barriers, and (3) climate instability that calls for global environmental stewardship (Boix-Mansilla and Jackson 2011). These three driving factors shape our lives and create the pressing need for educational approaches that prepare a new kind of graduate for a world of growing cultural interaction and diversity. Graduates should not only be competent in their chosen content domain but also be able to apply acquired knowledge, skills, and awareness in diverse situations and become so-called globally competent. There is a well-documented body of

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research on global competence, which can be broadly defined as dynamic pursuit of knowledge (i.e., the understanding of social, political, economic, and environmental issues related to one's own and a foreign culture), skills (i.e., second-language proficiency as well as a range of personal capabilities to identify and collect local, national, or international sources of information), and attitudes (i.e., the perspectives of individuals on cultural differences and a willingness to adapt to foreign communities and work environments) that together enable individuals to communicate and work effectively with those who have different perspectives, worldviews, and disciplinary and cultural backgrounds from their own (Boix-Mansilla and Jackson 2011; Hunter et al. 2006; Lambert 1994; Li 2013).

Global student mobility (i.e., students traveling physically or virtually to another country in pursuit of a part of or their whole academic career) is considered as a way to acquire global competence. Studies abroad, exchange programs, and internships have traditionally been utilized as the primary educational resources to immerse students in other cultures and instill global perspectives (Hill 1991). The experience of living, studying, or undertaking virtual programs in a different cultural context is instrumental in fostering students' respect for diversity and capacity to manage other cultures and in creating greater employment opportunities. Over the last 50 years, global student mobility has been evaluated in numerous studies and found to produce positive results in terms of cultural and global competence development (Jacobone and Moro 2014; Machorro 2009; Nash 1976; Paulusse 2014). However, some studies have pointed to problems such as high costs and time investment. Studying abroad benefits employability, but not universally; studying abroad is often designed as an optional component in most higher education programs, and it requires active guidance/supervision to achieve program outcomes (van 't Klooster, E 2014). Notwithstanding these complications, the exposure to other cultural, political, or economic contexts via global mobility makes it possible for students to reflect on their own cultural qualities/characteristics in relation to other cultures, learn intercultural skills, understand multiple contexts, and engage in comparative analysis of their own and others' worldviews. Educators, in turn, must provide opportunities for students to be globally mobile that can help students prepare to live and work in a world of growing diversity and complexity.

The following paragraphs review the three selected driving forces (globalization, technological advances, and climate instability) and elaborate on how educational practice responds to them by preparing globally competent students. In doing so, we consider student mobility as a crucial way to develop global competence.

47.1.1 Globalization as Driving Force

Globalization affects our lives because of a continuous exchange of information, products, capital, ideas, and other artifacts of culture. For instance, a pair of pants sold in the Netherlands may have been made from Indonesian cotton by workers in China. Then it may have been shipped on a British freighter with a Russian crew.

Other examples of globalization are McDonald's and Starbucks to be found in almost all big cities around the world. Projects in industry, multifunctional design, academia, health care, web design, and international law frequently involve professionals working together in real and virtual multidisciplinary teams spread across the globe (Sheppard et al. 2004). The United Nations Population Division reported the total number of migrants in the world has reached about 232 million by the year 2013 (UN, September 2013).

According to the UNESCO, there are more than 3.4 million students studying outside their own country as of 2009, whereas in the 1960 there were only 238 thousands of students globally (Chen and Barnett 2000). UNESCO expects the number of international students to reach about seven million by the year 2020 (Altbach et al. 2009) and 7.8 million by the year 2025 (Boehm et al. 2002).

Student and scholar mobility has been a common practice since the eleventh/twelfth century when the first universities were established. However, the number of international students has increased over 95 % over the last 10 years (Knight 2014). The pace, numbers of students, formats, motives, directions, and outcomes of the global student mobility have been significantly transformed over the last decades due to several social, political, and economic factors that influence students to undertake all or part of their education experience abroad. According to Knight (2014), there are three generations of global student mobility such as (1) student/people mobility, (2) program and provider mobility, and (3) education hubs (for an overview, see Knight 2014). Over the past two decades, these three generations of global mobility have evolved due to a complex interplay of many push and pull variables like revenue earning, skill migration, selection of courses and programs, and quality of course provision (Choudaha and De Wit 2014). The push and pull variables are the social, economic, political, and cultural factors that either hamper or enable global student mobility. For example, in the last 15 years, the USA, the UK, and Australia remain the top three hosting countries for international students (OECD 2012). Referring to Choudaha and De Wit (2014), in 2000, 23 % of all globally mobile students were enrolled in the USA, 11 % in the UK, and 5 % in Australia. Stricter immigration policies in the USA after 9/11 made it more problematic for international students to enter the country, whereas Australia and the UK became less strict. The recent economic growth in East Asian countries like China, Hong Kong SAR, India, Taiwan, Singapore, Malaysia, South Korea, and Japan has led to large investment in R&D and gradually transforms these countries into receiving countries of international students.

47.1.2 Technological Advances as Driving Force

Another prominent driving force is the advancement in computer and information technology that shapes almost all aspects of our everyday life. Today, people communicate with others across cultures and distances with the help of technology for personal, professional, or educational purposes. In the rapidly changing workplace,

many organizations use computer-mediated communication tools to telecommute and work from virtual offices without the nuisance of physical and time barriers. Collaborating centers or geographically dispersed teams in different time zones transfer work so that every center or team member is working during the daytime, which is known as the 24-h knowledge factory. Over the past decade, technological inventions have been introduced every week and this trend continues to grow. The Internet and telecommunication technologies strongly contribute to globalization in many areas. In education, the growing multicultural student population of universities and the introduction of virtual collaboration in education mirror the contemporary Internet-based and intercultural workplace of many professionals. In response to this situation, many universities are using new technologies as learning environments and implementing virtual campuses to better prepare students for the working world after graduation.

The vast and rapid expansion of technology worldwide is changing the traditional forms of student mobility. The most recent and biggest change in this regard is the introduction of Mass Open Online Course (MOOC) programs in September 2011 at Stanford University. MOOCs provide free or very inexpensive and certified programs that contain course materials such as videos, readings, exercises, as well as interactive forums that help build a community for learners and teachers. Several MOOC providers emerged, mostly associated with top universities, including Coursera and Udacity at Stanford and edX run by MIT and Harvard. Over the past 2 years, MOOC offerings and enrollments have grown rapidly; as of May 2014, more than 900 MOOCs are offered by only US institutions. The typical enrollment size of a MOOC course is about 20,000 students, but potentially can reach up to about 300,000 (e.g., Udacity's Computer Science 101, with an enrollment of over 300,000 students). MOOC is definitely a hallmark of contemporary education and a major change in accessibility to higher education worldwide in general and virtual mobility in particular. But, the effectiveness of MOOCs in comparison to traditional forms of education has still to be proven.

Another emerging form of virtual mobility is the Global Classroom. The Global Classroom implies creating a virtual environment of one joint classroom where students from two or more schools in different countries receive instructions from one teacher as if they are in the same classroom. Using collaborative technologies in the Global Classroom creates both potential benefits – by promoting cooperative learning and sharing culturally divergent knowledge – and challenges, in terms of equitably supporting learners, specifically with different cultural backgrounds. The Global Classroom programs engage educators and students via online learning and team projects with participants usually at the higher and secondary education levels. There are a few prominent programs in the field, such as SUNY Collaborative Online International Learning, Global STEM Education Center, East Carolina University offering "Global Understanding" course, Global Nomads Group, MOVINTER (enhancing virtual mobility to foster institutional cooperation and internationalization of curricula), REVE (Real Virtual Erasmus), VMCOLAB

(Virtual Mobility Collaboratory), iEARN, Soliya, and ePals. The virtual mobility programs expand cultural and technical competencies and give students a learning advantage in preparation for the global workforce.

47.1.3 Climate Instability as Driving Force

Examples of the most essential environmental concerns today include climate change, the greenhouse effect, sea-level rise, the increasing demand for food, global dimming, natural disasters and their consequences on the environment, nuclear meltdown, radioactive waste, ecosystem destruction, water pollution, soil contamination, air pollution and other pollution issues, and impact on human health. Since we all share one planet and live in an interconnected world, the responsibility of individuals in every country is to reduce the risks of these pressing environmental concerns. Globally competent students should prepare for the interconnected world by learning how to investigate, recognize, communicate, and take action regarding globally important environmental issues (Boix-Mansilla and Jackson 2011). Globally competent students should be able to connect the local to the global, for example, by explaining the use of renewable energy sources (solar, wind power), recycling, and sustainable living at a local level and how these can make a difference at a global level.

Several educational initiatives have been launched to respond to the most essential environmental concerns by preparing globally competent students. Students actively participate in person or online in the various interschool and/or university networks of environmental study/research groups. For example, the Global Connections and Exchange My Community, Our Earth Youth TechCamps offers high school students from the USA, Bolivia, Panama, and South Africa an opportunity to work together in cross-cultural teams on the use of Geotechnologies for Climate Change and Environment. Another example, the International Study Visits Environmental Sciences at Wageningen University, requires students from the Netherlands and Ukraine to collaborate on a 2-week project (first week online and second week on a face-to-face basis) to study two major environmental disasters, Chernobyl and Fukushima, in connection with the theme of "radioactivity and nuclear power" (Popov et al. 2014).

On the basis of the literature, we examined studies that specifically focus on the effects of student mobility on global competence development. The results of student mobility relating to the development of global competence played out differently in various studies depending on a number of factors that were either accounted for or not: form of mobility, pretest measure of intercultural competence, methods used in mobility research, study abroad intent, pedagogical interventions, institutional differences, and many others. These differences along with the study details are described below to summarize the students', teachers', and education institutes' experiences with developing global competence through student mobility.

47.2 What Are the Effects of International Student Mobility on Global Competence?

In the following sections, we summarize theory and research on global competence by paying particular attention to existing pedagogical and methodological approaches for its development through student mobility. Then, we synthesize pedagogical findings on the benefits of students traveling physically or virtually to another country in pursuit of their education in relation to global competence development.

47.2.1 At a Glance

The literature about international student mobility clearly shows that students generally highly appreciate their stay abroad. They are aware of the new skills learned, the extra knowledge gained, and sometimes a shift in attitudes, reflected in expressions as "I came back as a new human being" or "This was a life-changing experience" (Root and Ngampornchai 2013). A placement abroad is "an important activity for vocational students to learn about their profession abroad, but above all to learn about life, flexibility, adaptation, acceptance of different situations, etc." (Paulusse 2014, p. 14). The popular European exchange program ERASMUS is valued as a "largely enjoyable experience" in a research among 190 Italian ERASMUS students (Jacobone and Moro 2014, p. 14). The LEAFSE[1] experience is labeled as "a significant life experience" (Wals and Sriskandarajah 2010, p. 13). Positive effects are also mentioned by employers who report that internationally experienced young graduates have higher competences than those without international experience, referring to adaptability, initiative, the ability to plan, and assertiveness, in a big survey about the professional value of ERASMUS (Janson et al. 2009). The students in this survey report 5 years after their experience abroad a positive effect on getting their first job and obtaining a position and income that fits their level of education. The results, however, should be interpreted with care, because the researchers notice that the ERASMUS students participating in this survey are a selective group of students of whom more than half had prior international experience.

Nevertheless, there is ample evidence in the literature on student mobility that exposure to a different culture by a study or internship abroad in itself does not guarantee a growth in global competence (Vande Berg et al. 2012; Pedersen 2010). The learning outcomes of international study or internships are influenced by many factors such as motivation of the students, institutional support, prior intercultural and international experiences, the length of the stay abroad, whether mobility has

[1] LEAFSE: Learning through Exchange about Agriculture, Food Systems and Environment, a European Union-Australia student exchange program that took place in 2004 and 2005.

the form of an internship or a study exchange, the guidance of engaging skilled instructors, or an intercultural curriculum (Paige et al. 2012). The exposure to a foreign culture can lead to either greater flexibility or greater rigidity (Maddux et al. 2010). In addition, international students may differ with regard to their academic preparedness and financial resources, and according to Choudaha and his colleagues (2012), they thus can be classified in four groups: strivers (students pursuing their education while being employed part time, seeking for financial aid opportunities, and striving for getting education in prestigious universities), strugglers (students having limited financial recourses and lacking some academic preparedness), explorers (students pursuing not only their academic interests but also getting new personal experiences from living and studying abroad), and highfliers (students aiming at getting prestigious education abroad and being able to afford this without financial aid from the university). In this way, outcomes of global mobility programs in terms of a growth in global competence cannot be directly generalized to other fields of study without additional research due to the different types of international students and the varying level, depth, and length of their exposure to a different culture and institution.

47.2.2 Research Regarding Global Competence and Student Mobility: Scope, Assessment Methods, and Instruments

Most research has been done at the level of higher education. Noticeable is the relative underrepresentation of vocational and professional education institutes in the research literature. Tran (2012, p. 493) writes: "There has been a lack of theoretical and empirical research on the learning characteristics of international students in vocational education while extensive research has been devoted to these issues in higher education." Tran refers to the role and position of international students in vocational education, but also little has been published about the results of global mobility of national students in vocational education. Furthermore, there is an overrepresentation of research that focuses on American students studying abroad or international students in the USA.

What is measured in the body of research about global mobility is also different: enhancement of creativity, intercultural competence development, the position on the scale of Intercultural Development Inventory (IDI), efficacy of intercultural pedagogy, career development, the creation of a community of learners, practices and perceptions of teachers preparing students for study abroad, etc.

Traditionally, methods used in student mobility research are anecdotal research, retrospective survey, or quasi-experiment with the use of a pretest-posttest design with or without a control group to measure changes in students' knowledge, skills, and attitudes over time (van 't Klooster, E 2014). If a pretest-posttest design is applied, these instruments measure the perceived growth in global competence by the students themselves, but do not represent changes in actual behavior or attitude.

Sometimes additional instruments are used to complete the pretest-posttest information. Van den Hoven and Walenkamp (2013), for example, used additional interviews with the students and 360° feedback forms, completed by teachers, fellow students, parents, and friends of the students.

In most of the research, the time span between the stay abroad and the posttest is short. A few researchers report about the long-term effects of international mobility. For example, the US-based Institute for the International Education of Students did a survey among over 3000 participants of its programs from 1950 to 1999. The results show the impressive impact that study abroad had on the career development of the participants, as Norris and Gillespie formulate: "an impressive 84 % of the alumni who worked internationally attested that their study abroad experience enabled them to acquire a skill set that influenced their career path" (Norris and Gillespie 2009, p. 390). Wals and Sriskandarajah report about the long-term impact of an intensive European Union-Australia student exchange program for master's level students in the fields of agriculture, food systems, and environment. The program contributed to the development of global competence; many students expressed that they had "become more sensitive to people with a different background, consider themselves more open and tolerant, and have a strong interest in what goes on elsewhere in the world" (Wals and Sriskandarajah 2010, p. 18).

While language skills and other professional skills can be measured by clear-cut, objective language and professional skills tests, this is not the case for global competence or intercultural skills. The similarity between most of the instruments assessing global competence is that they are based on self-assessment using digital questionnaires. The instruments to measure the learning outcomes or benefits in terms of global competence vary from the widely used Intercultural Development Inventory (IDI, Hammer et al. 2003) and Multicultural Personality Questionnaire (MPQ, Van der Zee and Van Oudenhoven 2000) to the Strategies Inventory for Learning Culture (Paige et al. 2012) and the Intercultural Sensitivity Index (ISI, Clarke et al. 2007) or the Intercultural Adjustment Potential Scale (Matsumoto et al. 2001 in Behrnd and Porzelt 2012, p. 216), the Cross-Cultural Adaptability Inventory (CCAI), the Critical Incident Questionnaire (CIQ, Behrnd and Porzelt 2012), the Survey on Intercultural (Relocation) Adaptability (SIA, SIRA, created by Grovewell LLC and R.S. Mansfield Associates), the Intercultural Sensitivity Scale (ISS, Chen and Starosta 2000), the Employability Development Profile (EDP, Dacre Pool and Sewell 2007), the Miville-Guzman Universality-Diversity Scale (Miville et al. 1999), the Intercultural Competence Profiler (ICP, Trompenaars and Wooliams 2009), the Spony Profiling Model (SPM, Spony 2003), the Global Perspectives Inventory (GPI, Braskamp et al. 2010), the Intercultural Readiness Check (IRC, Intercultural Business Improvement 2012), the Global Knowledge Inventory (GKI, Lohmann et al. 2006), and the Beliefs, Events, Values Inventory (BEVI, Shealy 2006).

Sometimes research findings are based on reflective journals (Root and Ngampornchai 2012) or narratives of educators (Foster et al. 2013). Root and Ngampornchai (2012) analyzed reflective papers of students who had returned from several education abroad programs. Gill (2007) uses multiple qualitative methods;

she investigated Chinese students' postgraduate learning experience in the UK applying a "case study format," using ethnographic and narrative methods including participant observation, informal in-depth interviews, and continual reflection on the participants experience and her own corresponding experience as an overseas student (Gill 2007, p. 170).

A comprehensive review of currently available assessment tools for intercultural competence by Matveev and Merz (2014) showed that across all models and tools the integral intercultural competence dimensions are either cognitive, affective, or behavioral. Specifically, there are at least six cognitive dimensions (i.e., culture-specific knowledge, attitude, open-mindedness/flexibility, critical thinking, and motivation), two affective dimensions (i.e., cultural empathy and emotional stability/control), and three behavioral dimensions (i.e., experience, social initiative, and leadership).

We will now present an overview of studies covering the effects of physical international mobility and subsequently the effects of virtual international mobility.

47.2.3 Studies on the Effects of Physical International Mobility on Global Competence

There is a large volume of published studies describing the role of global competence with varying degrees of operationalization, which resulted in multiple conceptual models of global competence and its terminologies (e.g., global citizenship, intercultural sensitivity, global mindset, intercultural competence, etc.). This ambiguity is also reflected in the number and variation of variables measured in the reviewed studies. Drawing on the definition of global competence, i.e., dynamic pursuit of *knowledge*, *attitudes*, and *skills* that together enable individuals to communicate and work effectively in national and international contexts, below the reviewed studies are grouped and described based on the main variables that have been studied by various authors.

47.2.3.1 Studies Focusing on Students' Attitudes and Knowledge in the Domain of Global Competence

Cultural empathy, open-mindedness, social initiative, emotional stability, and flexibility were the elements of global competence studied by Stronkhorst (2005). He investigated the learning outcomes of international mobility at two Dutch institutions of higher education and compared students who did an international internship of 3–4 months as part of their bachelor program with students who studied for 3–4 months at a foreign partner institute. A clearly positive effect on the beforementioned elements could be established for only 35–45 % of the students of both institutions. Cultural empathy and open-mindedness were higher for the internship

group and flexibility was higher for the exchange group. Stronkhorst reveals: "Yet, it should be stressed that a considerable number of students at both institutions hardly made any progress at all and, even worse, the period abroad had a negative impact on the multicultural competences of quite a few students" (Stronkhorst 2005, p. 302).

A more open attitude toward intercultural communication and a greater flexibility to adjust to new people and places were reported by the undergraduate students of a US business school in the research of Clarke et al. (2007) as the outcome of their stay abroad. One group of students completed a semester of junior-level courses on campus. Another group completed the same coursework within a university in Belgium. The researchers conclude that "a study abroad semester helped shape students into more globally minded individuals" (Clarke et al. 2007, p. 176).

Hendershot and Sperandio (2009) focused in their study on identifying students' perceptions of the development of their global citizen identity (i.e., "one who is open- minded and accepting of other cultures in a respectful, tolerant and non-judgmental fashion…." p. 46) within the context of an undergraduate global citizenship program at Lehigh University in the USA and which program aspects, such as academic coursework, study abroad, and experiential/cocurricular learning, the students believed contributed to this growth. Abroad experiences were perceived by the participants as being the most important aspects in forming students' global citizen identities.

The following question was examined by Braskamp et al. (2009): "Do students change their self-evaluations on cognitive, intrapersonal, and interpersonal domains of global learning and development from the beginning to the end of their semester-long education abroad?" To answer this question, a pretest-posttest design without a control group was utilized to measure changes in students' global perspective, global awareness, and global engagement over the period of one semester. About 250 students, participating in this study enrolled in ten different education abroad programs from five different institutions, completed the GPI (Braskamp et al. 2010) both on the pretest and the posttest measures. Findings of this study showed progress in students' global awareness, global perspective, and global engagement over the education abroad experience. Students reported that they were learning how to analyze and understand cultural differences, but they did not gain or gained very little knowledge on "how to take these cultural differences into account in their thinking about truth and knowledge" (Braskamp et al. 2009, p. 107).

Intercultural awareness, personal growth and development, awareness of global interdependence, and functional knowledge of world geography and language were the elements of global competence that Chieffo and Griffiths (2004) researched. They compared two groups of students attending the University of Delaware in the USA. One group of students ($N=1509$) enrolled in short courses taking place abroad, and another group ($N=827$) completed similar short courses on campus. The students who enrolled in short courses abroad perceived themselves more confident in their levels of intercultural awareness and functional knowledge and engaged in more international activities than their counterparts who followed similar courses on campus.

A number of studies reported positive effects of study abroad participation on students' worldview and global perspective development (Carlson and Widaman 1988; McCabe 1994). For instance, Carlson and Widaman (1988) measured the perspective of 450 students on global issues and cross-cultural understanding before and after their study abroad. The study abroad experiences led to the formation of new and different worldview perspectives, higher levels of international political concern, cross-cultural interest, and openness to divergent cultural experiences compared to the students of control groups who did not participate in a study abroad program.

47.2.3.2 Studies Focusing on Students' Attitudes and Skills in the Domain of Global Competence

What we know about the effects of study abroad participation on students' global competence development is largely based upon studies using self-reported data on students' knowledge and attitudes. However, far too little attention has been paid to the assessment of the actual skills that create global competence. Below we review several studies that focus on not only cognitive and affective aspects but also on skills and behavioral dimension of global competence.

Jacobone and Moro (2014), in their research among ERASMUS program[2] students, evaluated three different levels of the ERASMUS program: output (self-experience), outcomes (acquisition of language, self-efficacy, intercultural and employability skills), and impacts (European and national identity) (Jacobone and Moro 2014, p. 2). The research method consisted of a two-wave longitudinal survey of two-student samples, Erasmus and non-Erasmus, resulting in a total of 352 students from the University of Bari who completed both pretest and posttest questionnaires. The researchers conclude that "the students participating in the best known and most popular student mobility programme in Europe perceive, upon their return from abroad, an increase in *linguistic and intercultural skills*, as well as more positive perceptions of self-efficacy" (Jacobone and Moro 2014, p. 14). Also each *employability skill* is perceived as higher among Erasmus students compared to nonmobile students.

Georgia Tech in 2005 introduced the International Plan, a comprehensive program that focuses specifically on global competence development including training in second-language proficiency, coursework in international subjects, and significant international experiences (a minimum of 26 weeks) (Lohmann et al. 2006). A 5-year quasi-experimental research was conducted to assess the validity of the conceptual model and to compare the learning outcomes in terms of global competence of the International Plan students against students who engaged in less-intensive international experiences and students who did not engage in any international activities. Pre-/post-surveys of students who either studied or worked

[2] ERASMUS program is the European exchange program, named after the well-known traveling scholar Erasmus of Rotterdam (1465–1536) (Knight and de Wit 1999).

abroad found significant gains on the general self-efficacy scale (an individual's *ability to cope with stressful life events*), as well as gains in self-reported competence to *practice their discipline in different social or cultural settings*, and an increased understanding of the host culture's beliefs and values. The results showed that students participating in full semester abroad programs (16 weeks) have higher gains in intercultural sensitivity than students participating in summer (8–10-week) programs. However, the results on the Global Knowledge Inventory (a set of questions on international systems, international political economy, and comparative politics/culture) showed that International Plan students did not score significantly higher than groups with lower levels of foreign exposure.

Global engagement (e.g., working for the common good, enhancing social justice, and environmental preservation) was studied by Fry et al. (2009) who examined the long-term impact of study abroad among 6391 former study abroad participants (from 1960 to 2007) from 22 US colleges and universities. Students who studied abroad have globally engaged in different ways in subsequent years and were more likely to *demonstrate global values*.

An *increase of a student's diversity of contact*, expressed by, e.g., "I am interested in learning about the many cultures that have existed in this world" and "I often listen to music of other cultures," was found by Salisbury et al. (2013). They used longitudinal data from the 17 participating institutions of liberal arts education to test the impact of study abroad on intercultural competence. The analytic sample included 1647 students and pre- and posttest measures including a control group were applied. However, it seems that study abroad participation has little impact on a student's appreciation of cultural differences (e.g., "Knowing about the different experiences of other people helps me understand my own problems better").

AFS Intercultural Programs, one of the largest high school exchange organizations operating worldwide, conducted a long-term impact study, which showed that 89 % of AFS participants who subsequently study abroad in conjunction with their university studies *speak at least one foreign language*; 45 % of AFS participants who also study abroad in conjunction with university studies report *having professional networks outside their own culture*. AFS participants who also study abroad in conjunction with university studies have *lower intercultural anxiety levels*, and they have higher IDI scores (Hansel 2008).

Surveys conducted by van 't Klooster (2014) among over 1000 students have shown that study abroad participation was not universally beneficial. His study shows that students who did their studies, internships, or short-term programs in low-income or socialist countries benefit much less from their international experiences in terms of technical, intra-, and interpersonal management skills as well as cross-cultural competencies. Van 't Klooster (2014) also suggests that the following factors may determine the learning outcomes from international experiences: very short period of time abroad, staying in an expat bubble, poor quality of employment, and lack of reflection activities after study abroad.

This review reveals that in many studies positive effects of physical mobility on global competence development were found, such as more linguistic and intercultural skills and higher perception of self-efficacy and employability, greater

flexibility, an increase in the diversity of contacts, and international engagement and more professional networks outside their own culture. These effects, however, are not a linear result of the mobility programs. Length of stay, monitoring of the students before, during, and after their stay in a foreign country by offering intercultural input and reflection activities, and motives of students are among the factors that influence these positive effects. Some studies even found no negative effects, implying that mere participation in a mobility program does not automatically lead to a growth in global competence.

47.2.4 The Effects of Virtual Mobility on Global Competence

According to UNESCO there are about 3.4 million students who study abroad each academic year. It means that only 2 % of all student population is "physically" participating in international academic mobility. However, one of the ways in which educators can provide more opportunities for students to have international experience is through virtual mobility. Several projects and programs on virtual mobility, mostly initiated in various institutions in Europe and the USA, have shown its benefits. However, there are relatively few empirical studies addressing evaluations of virtual mobility programs that are specifically designed to explore the impact of the use of educational technologies on the development of students' global competence. And among the few studies actually carried out, the main focus was on student cultural competencies, the use of educational technology to interact and collaborate with unknown colleagues, students' global competence level both before and after the study, students' interest in and knowledge of global issues, as well as the skills needed for competence as a citizen in a globalizing world. Below we review some of these studies.

In a study by Li (2013), 68 students from China and the USA worked in culturally heterogeneous pairs on a semester-long project related to international business using virtual communication technology (namely, the Microsoft Windows Live Messenger). The pedagogical intervention that was proposed in this study was a research paper assignment that required students to collaborate virtually with international partners. More specifically, the students were encouraged to integrate knowledge they acquired from multiple disciplines into meaningful business solutions working on various research topics (e.g., finance, human resource management, marketing, etc.). Participants' global competence level both before and after the study was measured. Global competence in Li's study was operationalized as "one's ability to transcend domain or discipline and properly comprehend cultural norms and global events so that one can interact, communicate, and work effectively outside one's environment" (Li 2013, p. 127), and it was measured on the basis of a three-dimensional taxonomy targeting global attitudes, knowledge, and skills. The results showed that the American and Chinese students had similar levels in knowledge and skills dimensions; however, the American students had gained significantly more in attitudes.

Significant gains in knowledge in global issues and skills needed for global competence were the result of an educational program, developed by Johnson (2011) and her colleagues. The GlobalEd project is a problem-based learning simulation, which was integrated within the middle school and high school social studies classroom, utilizing email and online discussion formats to facilitate communication between groups of students ($N=260$) at geographically dispersed school locations. The GlobalEd project assigns school students to a specific country to work for 5 weeks in virtual groups on five topical areas and behave as diplomats consistent with their assigned country's foreign policy.

The impact of a wiki-based international collaboration project on participants' cultural competencies and comfort, using technology to collaborate with unknown colleagues, was evaluated by Ertmer and colleagues (2011), in their research among preservice teachers ($N=202$). Each team was composed of seven or eight members from the USA and was paired with two to four international students from England, Russia, South Korea, or Sweden. Every team was asked to create collaboratively a wiki chapter about a specific social media tool (Facebook, Twitter, Mindomo, etc.). Results from this study indicated that engaging in a 5-week cross-cultural wiki development project had a significant impact on the development of students' cultural competencies (e.g., cross-cultural awareness and acceptance of differences among others), measured by a pre- and post-survey Miville-Guzman Universality-Diversity Scale (Miville et al. 1999). Furthermore, the research findings demonstrated that participation in a cross-cultural technology-enabled collaboration had a significant positive impact on students' perceived comfort for using computer-mediated technologies to collaborate with culturally diverse colleagues.

A number of ongoing research projects aim to examine the impact of virtual mobility programs, which use educational technology and cross-cultural collaboration to foster greater global competence development (e.g., GlobalEd 2, Soliya, Global STEM Education Center). The results of the studies so far look promising. It is important to find out exactly what that impact looks like and how comparable the impact of virtual mobility is in relation to physical student mobility. Furthermore, little is known about blended or hybrid forms when virtual mobility serves as a complement to the existing physical mobility. Future research needs to target the blended form of mobility since graduates need skills to function effectively in both worlds: physical and virtual.

47.3 Implications for Educators

Research findings implicate that if global competence is a goal of international mobility programs, "we need to do much more than send students abroad to study" (Pedersen 2010, p. 77). Based on the literature, the effect of mobility programs is mainly influenced by the curriculum and/or content of the program and by the quality and activities of teachers, and these factors are interconnected.

47.3.1 The Curriculum and Content of the Program

The formulation by education institutes of clear goals and objectives for the study or internship abroad, and which specific global competencies are addressed, is considered to be of high importance by Trede et al. (2013). The researchers interviewed academic staff of Australian universities, who were responsible for international activities, about their practices and perceptions of preparing students for these experiences. They found that although all the international programs in which the staff members were involved were well planned with regard to procedures, a clear intercultural learning purpose with regard to developing intercultural or global competence in their students was lacking. Related to this is the importance of assessing the students' performance. One of the world's leading organizations in the field of education abroad is "the Forum on Education Abroad," which developed a "Guide to Outcomes Assessment in Education Abroad" (Bolen 2007). This guide provides a number of tools for researchers and practitioners interested in designing and assessing education abroad outcomes as a part of education abroad programming. In an investigation into assessing intercultural competence, Deardorff's (2006) Delphi study revealed that 23 intercultural scholars who participated in her research chose case studies and interviews as the best to assess intercultural competence. They also mentioned narrative diaries, observations, and judgment by self and others as being important assessment methods. Boix-Mansilla and Jackson (2011) advocate ongoing global competence-centered assessment that should make use of a variety of methods, such as students' presentations, video productions, and graduation portfolios.

Another aspect related to curriculum design is the implementation of an international pedagogy, described by Tran (2013) as: "an approach to teaching and learning, which adds value to student learning and incorporates international examples, case studies, and broader dimensions of knowledge and skills. It reaches out beyond competency-based training to include the wider cross-border contexts" (Tran 2013, p. 503). This international pedagogy also includes guided facilitation and reflection and a balance of challenge and support, for example, by taking students out of their comfort zone, providing assignments to increase contact with the host culture and class discussions for increased meaning making (Pedersen 2010; Brewer and Cunningham 2009; Root and Ngampornchai 2012; Berardo and Deardorff 2012). The comprehensive literature review of Vande Berg et al. (2012) reveals that interventions before, during, and after the study abroad learning process are essential to increase the global competence of students. Interventions include instruction on both verbal and nonverbal communication and how language reflects culture, cultural mentoring, the provision of cultural content and of the opportunity for students to reflect on their experiences, and providing opportunities for active engagement with the host culture. Dutch students who were interviewed after their study or internship abroad emphasized the importance of being forced to reflect on their experiences during and after their stay abroad, in order to recognize and acknowledge the impact of these experiences on their professional development and competence (Van den Hoven and Walenkamp 2013, p. 107).

Pedersen (2010) compared students who participated in a year-long study abroad program with and without intercultural pedagogy including cultural immersion, guided reflection, and intercultural coaching. Scores on the IDI of both groups were compared with scores of a control group of students who stayed at home (Pedersen 2010). Previous travel experience and the presence of intercultural pedagogy appeared to have most influence on their intercultural competence. Interestingly the group that traveled abroad, but did not participate in the extra intercultural pedagogy activities, did not have a significant change in their IDI scores.

A third important factor that contributes to a more effective international mobility program is the formulation of specific learning goals by students. Students should be assisted in formulating these goals, for instance, by offering predeparture workshops that "1. assist study abroad students establish goals for their international experience, which primarily include aspiration to learn more about the culture and people in the country in which they will study, 2. reinforce students' goals to become more cross-culturally sensitive and knowledgeable, and 3. change students' social goals into goals which focus on gaining cross-cultural sensitivity and understanding" (Kitsantas 2004, p. 449). Facilitation of student awareness of these learning goals before, during, and after the study abroad program is stressed by Williams (2009). The importance of establishing goals is supported by the findings of van 't Klooster (2014) who suggested that students should think carefully about what competencies they want to achieve and choose the type of their international studies accordingly. For instance, participating in international research projects will improve management competencies and not so much cross-cultural competencies, as compared to becoming a student or an intern abroad.

A last factor mentioned in literature is the length of the stay abroad. The longer duration of a program abroad significantly impacts the development of students' intercultural sensitivity (Medina-Lopez-Portillo 2004). Behrnd and Porzelt (2012) accomplished two separate studies in which they compare the intercultural competence of German students with and without experiences abroad. The length of stay abroad appeared to be of importance in obtaining a higher score in strategic intercultural competence. The authors conclude that students should have time to build rewarding relationships with members of the host culture and to reflect on their experiences (Behrnd and Porzelt 2012).

47.3.2 Quality and Activities of Teachers and Trainers

Cultural mentoring and the value of having a cultural mentor appear to be one of the major factors enhancing the intercultural sensitivity of students as a result of their stay abroad. These cultural mentors should be well trained and prepared, whether they are faculty, in-country professional staff, or others (Vande Berg et al. 2012; Trede et al. 2013). The research of Tran (2013) showed that there is a lack of adequate and coherent professional development for VET teachers in Australia in relation to how to adapt pedagogy and work effectively with international learners.

Recent research by Gaalen et al. (2014), providing an inventory of Dutch higher education institutions' policies in the area of internationalization at home, underscores the importance of active supervision by teachers and trainers and the role of reflection, stating: "the yields of improved mobility can be further increased when institutions actively supervise students during their stay abroad and help consolidate their learning experiences after the end of the stay by means of self-reflection assignments and testing" (Gaalen et al. 2014, p. 3). The commitment of staff involved in the mobility program played an important role in the positive personal and professional development of the students who participated in the research of Wals and Sriskandarajah (2010).

47.4 Conclusions

Global competence is among the new abilities needed for graduates to operate successfully in a world of growing diversity and complexity. Knowledge of what international experiences best instill global competence and what means should be used to assess the level of its development is still in the process of scholarly inquiry. Not only educational policy demands but also empirical evidence calls for a more solid grounding of global competence attained through international mobility programs.

There are several approaches to increase global competence among students. These may include internationalization of university curriculum by incorporating additional international courses, creating a special degree program and/or fostering foreign language proficiency, but promoting international experiences and knowledge attained through global student mobility is still the most popular pedagogical approach among educators. However, sending students to another country is in itself not sufficient to reap the benefits of this international learning experience. Our literature review showed that there are a number of determining factors that can affect, foster, or impede the development of global competence. First, students traveling abroad cannot be generalized and put in one category as "international students." There may be distinguished at least four types of students, depending on their motives and financial resources (Choudaha et al. 2012). Therefore, the growth in global competence of different types of mobile students can vary due to initial variations in their personal incentives and levels, depth, and length of the exposure to a different cultural context.

Second, only in recent years, there has been an increasing interest among educators to unify their efforts in terms of internationalization initiatives which focus on conceptual models of global competence, curriculum modalities to instill it, and measurement standards to guarantee that graduates can operate successfully in a global environment (for an overview, see "The Forum on Education Abroad"; Boix-Mansilla and Jackson 2011). The emphasis is put on the assessment of the actual skills that create global competence and that would enable students not only to recognise, understand, and appreciate certain intercultural differences but also to

reconcile these differences by realizing the necessary actions (Trompenaars and Wooliams 2009).

Third, research by Daloz (2000) has indicated that acquiring global competence through student mobility is a type of transformative learning which requires at least five essential prerequisites: (1) exposure to a different (cultural) context and contact with the host culture; (2) a long period of time; (3) reflection activities through discussions for increased meaning making; (4) guided facilitation or teachers' active leadership role in cultivating students' global attitudes, knowledge, and skills throughout the whole educational program; and (5) commitment to the goal of learning which is to construct knowledge about themselves, others, and social norms. In the process of transformative learning, students experience shifts in their mental models, which lead to the formation of new perspectives and behavioral practices. If at least one of these prerequisites/conditions is not successfully fulfilled, the international program objectives may not be achieved (see Stronkhorst 2005; Gullekson et al. 2011; Salisbury et al. 2013). For instance, student's knowledge and experiences acquired while studying abroad that are disconnected from routing learning activities throughout the whole educational program are likely to be ineffective and temporal. Furthermore, it has been suggested by many authors that education institutes need a clear vision and correlating strategy on the "what, why and how of various international orientation activities" (Stronkhorst 2005); a coherent trajectory of predeparture courses or seminars, cultural guidance when abroad, and reflection activities when the students return can best instill global attitudes, knowledge, and skills (Van den Hoven and Walenkamp 2013; Vande Berg et al. 2012).

The goal of this literature review is to help researchers and educators as they seek to understand and improve the global competence of their students by immersing them in other cultures either physically or virtually. Studies that are mainly based on self-report data suggest that study abroad participation appears to increase students' worldview and global perspective development. However, according to studies that used control group designs and behavioral and implicit attitude tasks to measure global competence, it seems to have little impact on a student's appreciation of cultural differences and its integration in students' thinking about truth and knowledge. Notwithstanding this, research also suggests that student mobility can be a powerful educational instrument to instill global competence, provided the availability of a high-quality curriculum maximizing the potential of study abroad programs and high-quality cultural mentoring offered by teachers and/or trainers.

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Chapter 48
Social Competence Research: A Review

Susan Seeber and Eveline Wittmann

48.1 Introduction

Social competence is conceptualised differently across disciplines and even within disciplines, e.g. communication, psychology and sociolinguistics (cf. Antos and Ventola 2008), but also included in applied sciences such as education, social work, medicine, marketing and human-computer interaction.

In *psychology*, social competence is defined as a personal trait with different facets such as cooperation, assertiveness, empathy, trust, respect for other people and tolerance, conscientiousness, self-control and emotional intelligence. From a *pedagogical perspective*, aspects like social and intercultural learning, the ability to adjust to different social situations in learning, training and working contexts as well as the development of social competence over the life span are of interest. In *workplace settings*, social competence plays an important role as a prerequisite for good individual performance and for the effectiveness of companies and organisations. Concepts of social competence at the workplace are often associated with the notion of socially responsible behaviour independent of particular situations and requirements (e.g. Goleman 1995).

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Summing this up, a large body of research on social competence or social skills exists in psychology and education, where the construct is often tied to the idea of traits, to social behaviour in different situations and to personal development (e.g. Allemand et al. 2014).

It is also to be noted that in social competence research, there is a number of different definitions of the concept of competence. Correspondingly, a variety of operationalisations has been suggested. Following Weinert (2001, 62) competencies are '… necessary prerequisites available to an individual or a group of individuals for successfully meeting complex demands'. In addition to cognitive abilities, Weinert (ibid.) identifies motivational, moral and volitional components of competence. Based on this multidimensional concept of competence, we accept the perspective of cognitive psychology, including personal traits, capabilities, knowledge and skills in this construct. At the same time, we recognise the legitimacy of behavioural aspects when focusing on the adjustment to and interactions in different situations. In accordance with the approach of Argyle et al. (1985), we understand social competencies as relational properties. In particular, this aspect is relevant with respect to the distinction between – and possibly the interaction of – general, cross-occupational social competencies and such social skills which are specific to a particular vocation or occupation.

Correspondingly, Kanning (2009a) distinguishes three major views of social competence in psychology: clinical (e.g. Hinsch and Pfingsten 2002), developmental (e.g. Vaughn et al. 2000) and organisational psychology (e.g. Greif 1987). Clinical psychology views social competence as the ability to articulate personal interests or pursue individual goals and plans and does not take the role of interaction partners as subjects into account. The second perspective in developmental psychology is focused on the extent to which individuals adapt to their environments (e.g. The Consortium on the School-based Promotion of Social Competence 1996; DuBois and Felner 1996). A third group of research aims at integrating both positions and emphasises the necessity to negotiate interests between the partners and groups involved in social interaction (Rose-Krasnor 1997). Both in older and in recent research social competence is seen as a person's ability to analyse thoughts, feelings and behaviours of his-/herself and others and to select and implement the emotional, cognitive and behavioural resources which are suitable to deal with specific personal and social situations (e.g. Pinto et al. 2012; Gresham and Elliot 1990; Ford 1995).

From the perspective of vocational and professional education, only the last one of these positions seems appropriate. In this context, to act socially competent requires behaviours in accordance with learning and workplace requirements as derived from an organisational, vocational or professional perspective (e.g. Bailly and Léné 2014; cf. also Wang and Netemeyer 2002). Hence, when conceptualising social competence for vocational and professional education and training as well as for workplace requirements, a central question pertains to the dimensionality of social competence, whether it is specifically related to a particular domain or relevant across domains. Three main questions arise: (1) Which abilities, knowledge and skills constitute socially acceptable behaviour in varying professional and vocational contexts? (2) How are these abilities, knowledge and skills instantiated in different situations within a given context? (3) Which factors determine the emergence of these traits in the training and education leading to the different occupations and professions?

48.2 Conceptualising 'Social Competence': Generic vs. Domain Specific

Following Kanning (2002), social competence can be defined as a comprehensive potential in terms of knowledge, abilities and skills contributing to socially competent behaviour. Socially competent behaviour pertains to such behaviour that contributes to goal attainment in specific situations and secures social acceptance. It is usually conceived as the manifestation of different constituent traits as well as motivation, attitudes, value orientations, etc. In order not to confound these with behaviour induced by specific situational conditions, social competencies need to be diagnosed and generalised across a range of situations. Kanning (2002) therefore advocates a distinction between generic and domain-specific social competencies.

Social competence is typically understood as a relational construct, describing how individuals behave within the context of interpersonal and group relationships (Schoon 2009). Different social competencies are required and valued in different contexts (Argyle et al. 1985). Thus, social competence comprises positive aspects of interpersonal, intercultural, social and civic relationships (Schoon 2009). As Bailly and Léné (2014) argue, however, social competence only becomes relevant when significant autonomy exists in the workplace (similarly Kanning 2005; Wang and Netemeyer 2002). Drawing on examples of frontline workers in the service industry, retailing, hotel and restaurant business, these authors point out that the role of employees in direct contact with customers has expanded with regard to bargaining contracts and solving customers' problems. This has in turn increased the significance of social competence and other 'soft skills' for task performance in these domains. Workers are constrained by growing responsibilities for results, i.e. the requirement to internalise organisational norms as 'a self-disciplinary form of control' (Bailly and Léné 2014, 13). It follows from this that beyond the overarching shifts in the organisation of work, changing specific norms play a role in what constitutes socially acceptable behaviour and how it can be conceptualised. Moreover, these norms are likely to be explicitly expressed as vocational and professional expectations and standards, if these exist (Billet 2006).

Contrary to these tenets, social competence is usually conceptualised, even in professional contexts, as a set of rather general abilities, very much independent of specific situational workplace requirements (e.g. Hochwarter et al. 2004; Holling et al. 2007; Frey and Balzer 2007; Jennings and Greenberg 2009; Ramo et al. 2009; Kinman and Grant 2011; Kanning et al. 2012). No consensus exists, however, as to the degree of their transferability from one workplace to the next. Thus, the issue of specificity versus generality of social competence still needs to be clarified (cf. Heller 2002). It may very well be the case that the relationship between specificity and generality varies across vocational fields. In occupations and professions which are dominated by social interaction, specific knowledge may tend to assume an auxiliary role as a necessary but insufficient condition for successful performance. In professions where social interactions are less prominent, the converse may be true: here, specific knowledge may be primarily significant as opposed to

more general social traits. The possibility of such variation needs to be taken into account if an operationalisation of social competence is proposed.

The present article explores how social competence can be conceptualised adequately and how it is applicable to the notion of vocational and professional success. In pursuit of this goal, the issue of specificity versus generality is examined – as an example – across two specific areas of occupations and professions with a high share of social activity: (a) sales and services and (b) social and health care.

48.3 Social Competence as a Generic Construct

In this section, we will start by discussing problems surrounding the definition of social competence as a generic construct. While in the subsequent section we elaborate on the role social competence as a generic concept plays in vocational and professional learning, the third subsection debates the conditions under which social competence can be seen as a prerequisite to workplace performance and professional success. The fourth subsection refers to problems with a generic construct in the context of vocational and professional education.

48.3.1 Defining the Construct

According to Dirks et al. (2012, 2751), there is a growing consensus that the construct of social competence 'reflects effectiveness in interpersonal relationships' (cf. Rose-Krasnor 1997). Variations in interpersonal effectiveness may stem from individual differences, behavioural variety and situations – namely, 'the interpersonal circumstances in which behaviour is embedded' (Dirks et al. 2012, 2751) – and may also depend on the person who is evaluating the behaviour.

Following this perspective, social competence may be seen as a constituent trait such as social intelligence or emotional competence. But as a comprehensive potential underlying socially competent behaviour in terms of knowledge, abilities and skills, it is broader in scope than either of these.

A large number of authors have set up a list of individual trait variables deemed integral to social competence and corresponding training approaches (e.g. Segrin and Givertz 2003). These variables cover a great spectrum, e.g. empathy and social sensitivity (Adams 1983), facial expressiveness (Segrin and Givertz 2003), perspective taking assertiveness to emotional stability and even a sense of humour (Dirks et al. 2012). Conducting a second-order factor analysis across these constructs, Kanning (2009b) identified empirically the following principal components: social orientation, offensiveness, self-control and self-awareness (see Fig. 48.1).

Behavioural perspectives additionally take outcomes and criteria of goal attainment into account, for example, with regard to peer popularity or peer relations (Dirks et al. 2012; cf. Adams 1983; Ladd 2005). Situational factors, ranging from

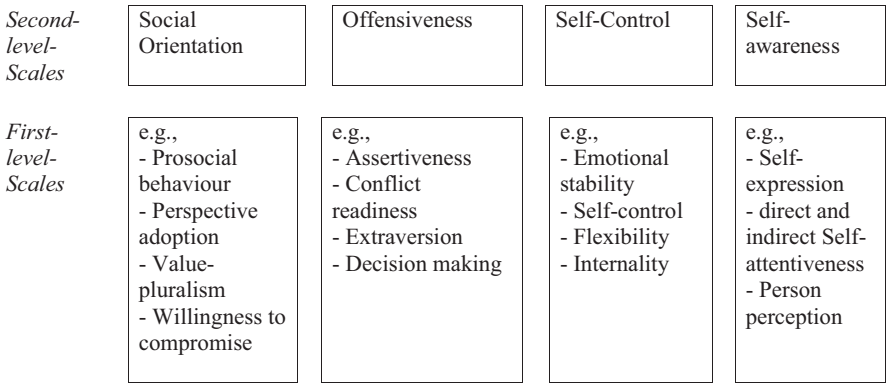

Fig. 48.1 Social competence inventory (According to Kanning 2009b)

features of classes of situations to singular situational circumstances, will influence behavioural-evaluative criteria (Dirks et al. 2012). However, there are still many open questions. The judgemental aspect of 'who evaluates' has largely been neglected (Dirks et al. 2010, 2012). As Dirks et al. (2012) point out, studies evaluating youth social competence have either relied on the extent of agreement between different judges – peers, parents and teachers – about an adolescent's competence or simply assumed consensus on what constitutes competent behaviour. They call attention to the fact that '[such] investigations leave unanswered the question of the extent to which important people in the social environment concur about the competence of specific behaviours' (Dirks et al. 2012, 2752). In addition to the aspects observed by Dirks et al. (2012), Kanning (2002) considers a temporal reference as an important element of conceptualising social competence, since competent behaviour may mean different things at varying points in time, a notion which complements, for example, Bailly and Léné's (2014) or Bloom's (2009) understanding.

48.3.2 Social Competence as a Prerequisite and an Outcome of Vocational and Professional Learning

Social and emotional competencies are seen as important predictors of success in schools (e.g. Blumberg et al. 2008, 177) and in professional and vocational learning, as well as in modern workplaces (e.g. Robles 2012). In this chapter, some light is shed on social competence in the context of vocational and professional learning and learning achievement. The promotion of social competencies is an important independent goal in vocational education and training, but it is also an important prerequisite for vocational and professional learning. In the view of Wenger (2003), "knowing is an act of participation in complex 'social learning systems'" (76), "a matter of displaying competencies defined in social communities" (77). As seen from this perspective, learning is understood as a social process, an interplay

between social competence and personal experience. Thus, socially competent behaviour is not only defined by social environments including organisations but also by the respective historical context. While it shapes personal experience, social competence, defined as "what it takes to act and be recognized as a competent member" (78), is also shaped by an individual's experience.

Under the perspective of learning, social competencies relate to very different abilities. A number of models have been proposed which show certain commonalities with the facets of existing generalised models of social competence while also stressing certain peculiarities in their acquisition. According to a meta-analysis of Calderella and Merell (1997), five distinct dimensions are constitutive for the acquisition and development of social competencies:

1. The ability to establish positive relationships within the respective learning/peer group, an ability listed as 'social orientation' in Kanning's model
2. The ability to cooperate, such as the acceptance of social rules (whose components are often subordinate to and distributed across several facets of generic competency models) and the constructive handling of critique (compliance)
3. Abilities of self-management, which Kanning subsumes under the construct 'self-control'
4. Academic competencies, which include, above all, teacher-student relationships focused on learning, that entail the ability to follow instructions or to ask teachers and other learners
5. 'Assertiveness', which implies the ability to initiate and maintain a dialogue or to maintain or terminate close social relationships such as friendships

Kolb and Hanley-Maxwell (2003) have proposed a slightly different model. Beyond 'peer and group interaction', 'self-management' and 'assertion', they emphasise the significance of 'communication' and 'problem-solving/decision-making'. The perfection of an appropriate language is seen as an important prerequisite of the development of social competence, given that language is the principal means of initiating and maintaining social relationships. Conversely, language deficits can inhibit the development of social competencies, e.g. by inviting rejection by the peer group. Correlations between linguistic and social abilities and skills have been observed not only in early childhood settings but also among adolescents, e.g. in a study of immigrant youth in Germany (Jerusalem 1992). These findings underscore the fact that language deficits inhibit the integration and opportunities for social participation, while language proficiency functions as a resource in establishing social relationships and skills. Based on this insight, in-school and in-firm support for the learner's acquisition of communicative abilities and skills contributes significantly to the emergence of social competencies.

Whereas the acquisition of social competencies in schools usually – with the exception of speech-impaired children – occurs through peer interaction, i.e. informally and without any pedagogical concept, vocational education and training present a clearly different scenario. Here, social learning, also labelled as collaborative learning, group learning, service learning, peer learning or tutoring, is assumed to have a positive impact on the development of substantive competencies. Also, social

learning is more frequently ascribed to learning at the workplace where team activities are typical, with one trainee learning from her or his peer. It is implicitly assumed that the inherent potential of social experience contributes to the emergence of social competency (Dubs 1995, 296). This is most likely to occur when the systematic, pedagogically structured nurture of specific facets of social competency is enhanced by the training of the intended substantive competencies.

It is to be noted, however, that, in the context of 'dual' vocational education and training and firm-based training, learning processes of social learning are not restricted to vocational schools but are also assigned to the firms, i.e. the workplaces. The latter 'occurs in the demand of action, effectiveness and productivity' and 'is most often rather incidental and spontaneous' (Thång 2009, 428/429). It is a place for formal and informal learning, where learning by experience and incidence on the one hand and organised, intentional learning on the other come together. In addition to substantive learning, the workplace is also assumed to have a special function in conveying social competencies. Here, in contrast to school settings, social competencies are acquired through contacts with different groups of persons from various levels in the organisational hierarchy and through contacts with external clients and partners of the firm. Consequently, the acquisition of social competence is also connected to affective organisational commitment and organisational citizenship (cf. Abraham 2005, 263/264).

48.3.3 Social Competence as a Prerequisite for Workplace Performance and Professional Success

In occupational and professional contexts, social competence is sometimes referred to 'soft skills' or 'emotional intelligence' and denotes traits such as flexibility and abilities to work in a team, to motivate colleagues and clients and to show effective leadership.

Robles (2012, 454) lists an impressive volume of research on the significance of social competencies at the workplace. Van Rooy and Viswesvaran (2004) have conducted a meta-analysis of 69 separate studies, resulting in robust and substantial relationships between the construct of 'emotional intelligence' and workplace performance. Insofar as the constructs of 'emotional intelligence' and 'social competence' clearly overlap, show many similarities and have interdependent components (cf. Kang et al. 2005), these research results may be also indicative of the relevance of social competence for vocational and professional success.

In recent years, a growing awareness of social competencies in the area of personnel recruitment and personnel development has been observed. More than ever, social competencies appear to function as the key to individual success as well as a necessary condition for the success of an enterprise as a whole (Crisand 2002). In occupations and professions, which are characterised by social and communicative acting, like professions in the area of social and health care or occupations in the

service and sales sector, social competencies have become an immanent part of vocational or professional competence. But they are also increasingly required in technical occupations and professions, for skilled manual jobs and for skilled work in production. A growing part of work orders and tasks is solved cooperatively. An increasing complexity of tasks requires multi-professional teamwork with specialists from various occupational and professional fields and from different status groups. Within large organisations, there are many project-based, short- and long-term relationships and formal and informal contacts that build up networks in order to share practices and goals. In other words, work results are obviously highly dependent on social relations and on the social competencies of persons working in these networks and groups.

In this context, it is helpful to distinguish between social competencies which refer directly to the provision of products and services, i.e. external contacts with clients and customers and those which are related to the internal process of the organisation. Whereas the former are likely to be akin to specific requirements of the job, the latter will have a high degree of transferability across occupations and professions.

48.3.4 Problems with a Generic Construct in the Context of Vocational and Professional Education

It has been mentioned above that Kanning (2002) distinguishes between generic and domain-specific social competencies. The assumption underlying his concept of general social competencies is that some social competencies are relevant independent of a particular social setting. In this view, other social competencies are relevant only in specific social settings. Kanning (2002) concludes that general social competencies are predominant in personnel *selection*. As opposed to this, domain-specific social competencies are of interest for personnel *development*, since they require context-specific training opportunities. An alternative would amount to the assumption that social competencies are always specific to a situation. Kanning (2002) rejects this notion, however, postulating a consensus according to which social behaviour rests on the interplay of situational and individualistic variables. While socially competent behaviour is invariably deemed to be specifically situational with respect to time, space, personal interests, local norms and other factors, some underlying traits may transcend situations and even domains.

Yet the existence of such a core of general social competencies which would be applicable across domains can be contested and remains to be questioned (Wittmann 2001a, 2003). Bloom (2009, 13) suggests, for example, the possession of ‘abstract moral values suitable to one’s life context and historic time’ as part of an operational definition of adolescents’ psychosocial competence (cf. Wilson and Sabee 2003 for a discussion on how ethics may enter into conceptions of ‘communicative competence’). However, Beck et al. (2001, 1999) show evidence of moral regression

specific to the area of external relationships of an insurance company subsequent to vocational education and training in the insurance industry. This may indicate that perspective taking is more important in private life or in some vocations than in others. Moreover, it is possible and perhaps even likely that the relationship between specificity and generality varies across vocational fields or between cultures within the same occupational field (Weeks et al. 2006). It seems important, therefore, to examine research on domain-specific variations of required social behaviour as well as social competencies associated with these requirements.

48.4 Social Competence as a Domain-Specific Construct

In this section, we will first discuss fundamental considerations of conceptualising social competence as a domain-specific construct, such as the interrelation of factual knowledge and social competence. In the following subsections, we elaborate on the issues suggested here, based on the state of empirical research for the selected areas of vocational and professional education with high shares of social interaction, which is sales and services as well as social and health care. The selection is also driven by the fact that these areas have attracted a considerable body of research.

48.4.1 Fundamental Considerations of Conceptualising Social Competence as a Domain-Specific Construct

Apart from the sales and services sector, social competencies in social and health care have been of particular interest in the literature (e.g. Argyle 1994; Street 2003). But research on social competence has been conducted in other vocational or professional areas as well, e.g. police work (Holling et al. 2007). More generally, it can be assumed that domain specificity is particularly strong in occupations and professions focused on working with other people, i.e. dialogical-interactive work (Hacker 2009).

From the sociological viewpoint laid out by Goffman (1959) in his writings on the ‘presentation of self in everyday life’, institutional interaction can be compared to a staged theatre performance. All public behaviour is conceptualised as leaving an impression upon spectators which they in turn interpret as a self-expression. Performance is meant to influence viewers. Professionals act using a standardised repertoire of expression – including clothing, physical appearance, ways of speaking and personal expression – labelled as ‘personal facade’. It is accompanied by the stage setting which includes the setup of the room and is meant to invoke certain definitions of the situation by the interaction partner. The surface, or ‘front stage’, of such staged performance is strictly separated from what is conceptualised as

'backstage', where professional actors interact out of sight of the viewer and suppressed facts come to light or are being dealt with.

Following Goffman's (1959) concept of staged interaction in institutionalised contexts, occupations and professions requiring social interaction can arguably be differentiated according to the way in which they relate backstage to front stage (Wittmann 2001a, b), both in terms of vocationally or professionally informed social perception and vocationally or professionally informed social expression (Nerdinger 1998).

An often neglected aspect lies in the role of the relationship between factual knowledge and social competence in the vocational and professional field. One possibility to address the issue of specificity is to assume that in occupations and professions that are dominated by social interaction, requirements of socially competent behaviour tend to be more specific to the demands of the audience, whereas factual knowledge is reduced to a rather auxiliary role – a necessary but insufficient condition for successful performance. Another possibility is that the factual knowledge and the recognition of social demands become intertwined to an extent where they cannot meaningfully be separated. Hence, the relationship between factual knowledge, social requirements and social competence needs to be clarified.

Another possibility is that social requirements and respective competencies across professions and occupations vary primarily with regard to the emotional underpinning (Gieseke 2007). As has been pointed out, e.g. by Zapf (2002), such 'emotion work' is comprised of automatic emotion regulation, namely, the so-called surface acting. This, on the one hand, consists of the visible display of expressions in contradiction to inner feelings, as opposed to 'deep acting'. On the other hand, it refers to the kind of behaviour where emotion is genuinely invoked through the inner search of thoughts, images and memories. Zapf's argument rests on Goffman's (1959) idea of drawing analogies between everyday social interaction and theatrical role playing (cf. Hochschild 2012). Emotion work occurs when face-to-face or voice-to-voice interactions between professionals and clients take place. Emotions are displayed in an effort to influence other people's emotion, attitudes or behaviour, and they are framed by certain rules. They also affect backstage behaviour (Zapf 2002). With this argument, Zapf (2002) follows the work of Ekman (1973), who emphasises the existence of 'display rules' for facial expression. It appears that this concept is highly compatible with the notion of social competence specific to different occupations and professions. The following is intended to explore this assumption.

48.4.2 Sales and Services

In sales and services, customer contact is acted out on what Goffman (1959) conceptualises as front stage, with the purpose of influencing customer impressions both at the level of individual interaction and at the management level. As opposed to this, company goals and strategies as well as production details and trade

conditions are decided upon backstage, either entirely or in the form of rough frameworks. Contracts are also processed in areas customers hardly get to access (Damiani 1991; Wittmann 2001a, b).

Following Goffman (1959), Wittmann (2001a, b) argues that the inhibition of customers' perceptions is a constitutive element for services and sales work in highly competitive markets. From the viewpoint of the customers, respective practices differ depending on the products and services provided. In banking, for example, some products may require expert explanation or simply risky investment on the part of the customers. While consumers trust in the company's problem-solving activities is vital for the perceived quality of sales and services, this in turn serves the latter's economic purposes of maximising company income (Brünner 1994). Thus, in the case of sales and services staff, expertise lies predominantly in the social domain. Knowledge about the supplied products may be necessary, but its display will be subject to and framed by strategies of impression management and influence. Hence, situations may arise where too much product knowledge by salespersons is deemed detrimental, in particular when this leads to empathising with customers in ways that prevent sales achievements.

In this regard, the concept of role becomes quite obviously important. The psychology of sales and services emphasises role conflicts and their perceptions by the staff involved as well as strategies to cope with these conflicts (Damiani 1991; Nerdinger 1998, 2001). Possible conflicts include the two-bosses-dilemma, resulting from contradictions between employer and customer expectations (cf. Katz and Kahn 1978 on the work roles of staff at the boundary of organisations; also Rastetter 2008), inconsistent goals of long-term customer retention vs. raising the short-term sales volume or conflicts between customer expectations and the self-concept and the values of the salesperson (Weeks et al. 2006). Conducting qualitative analyses of spoken text, linguists have investigated the variance between institutional contexts and viable avenues for solving such conflicts by means of communication and social interaction (e.g. Brünner 1994; Antos and Ventola 2008). Guiding the interaction process, influencing customer needs and managing conflict, but also managing relations preventively, and controlling self-expression become vital strategies to cope with these demands (Damiani 1991; Brünner 1994; Nerdinger 2001).

According to Homburg et al. (2012, 217) who summarise a broad range of empirical support for their theory, 'enduring sales success has less to do with special sales techniques, but rather essentially depends on three aspects' which these authors conceptualise as 'personality ', namely, 'social competence' and 'professional competence'. These personality traits refer to the extent that a salesperson consistently likes him- or herself and others and displays sociability, optimism, self-esteem and empathy. Whereas social competence refers to social interaction and includes general aspects of verbal and nonverbal communication with regard to both perception and expression, as well as components of situational adaptations, such as the possession of customer typologies, professional competence pertains to (hierarchically organised) sales-related knowledge, such as sales process knowledge, but also products, business or market knowledge. It also refers to knowledge about customers' environments, situations and needs, both in abstract and detailed forms, which

contribute to the salespersons' long-term success. A growing body of research supports this approach; see the literature discussed by Tschöpe (2013), who builds upon Hacker's (2009) theory on 'interaction work' and suggests that access to interaction partners' mental models is required to act adequately in the service industry. This includes general heuristics as well as situated reasoning for important or new situations (cf. also Nerdinger 2001). Successful salespeople use better customer typologies, i.e. better integrated knowledge structures of customer traits and negotiating strategies (Sujan et al. 1988). In addition to possessing richer descriptions and more distinctive categories, they classify customers according to their needs rather than physical characteristics (Sharma et al. 2000). However, short-term sales in an initial sales encounter are unaffected by differentiated typologies, according to a study by Evans et al. (2000). More successful salespeople appear to have acquired the ability to qualify or categorise customers according to both client types and associated product and selling requirements as demonstrated by their ability to provide information in accordance with customer needs (Román and Iacobucci 2010). According to a meta-analysis conducted by Franke and Park (2006), adaptive selling behaviour, i.e. the adaptation of the selling behaviour depending on situational information, contributes positively to sales performance as measured by self-ratings, manager ratings and objective measures of performance. Homburg et al. (2009a, b, 64) introduce the concept of 'customer need knowledge' (CNK) to describe 'the extent to which a frontline employee can accurately identify a given customer's hierarchy of needs'. According to these authors, customer need knowledge mediates the effects of both customer orientation and cognitive empathy exerted by salespersons on customer satisfaction and customer willingness to pay. Findings by Homburg et al. (2011), for example, based on a cross-industrial survey, suggest that customer orientation with regard to sales of individualised products success is optimal in highly competitive markets and for firms which pursue a premium price strategy. While customer orientation is consistently positively related to customer attitudes, its relationship to sales success seems to be curvilinear.

To sum up, the current state of research indicates the importance of certain general abilities, i.e. traits, but also the need for situational adaptation; the success of which is mediated by both abstract and specific knowledge. Such knowledge can be both social knowledge, as in the case of customer knowledge, and relate to product, organisational or market specifics. This model may be less successful, however, in areas where short-term sales success is the organisational or branch-specific norm.

As Nerdinger (2001) argues, emotion work also plays a significant, and possibly specific, role for competent social interaction in the sales and services industry. In particular, low status sales and services tend to be subject to impolite customer behaviour. As a result, emotional work on the part of the sales and services staff is required which includes the necessity to comply with job- and organisation-specific rules of expression (Rafaeli and Sutton 1987). Possible strategies in the sales and services industry are either characterised by surface acting or situational reinterpretation, such as reinterpreting unfriendly behaviour – rightly or wrongly – as customer anxiety (Nerdinger 2001). However, as Sutton and Rafaeli (1988) argue, such 'display rules' may also vary in response to specific situations. In their quantitative

study of a chain of urban convenience stores, the display of positive emotions was negatively linked to the sales figures. According to their qualitative research findings – obtained by these authors in case studies of four stores – busy and high-paced store settings required the rather neutral display of emotions, whereas slow settings tended to demand the display of positive emotions. This interpretation appeared to be compatible with the quantitative evidence.

While the requirement to display emotions seems to be common to sales and services work on the one hand and social and health care on the other, situations which require the pretence of emotion against personal convictions, which may even result in ethical conflicts, are apparently specific to sales and services work – although they may become more common with tendencies to apply business sector models to health-care institutions (Senghaas-Knobloch 2008; Rastetter 2008). When 'acting' is required irrespective of actual feelings, 'emotional dissonance' occurs, a term describing deviations of genuinely felt emotions from emotional expressions required by organisational or professional norms (Zapf 2002). In the view of Hacker (2006), it is this aspect that separates what he calls 'interaction work' from other types of work. Since their underlying purpose is the selling of products or services, customer relationships can be ended at almost any given time by the disclosure of such inconsistencies. Similarly, ethical behaviour, which implies authentic feelings, may often reduce the likelihood of successful performance (Gieseke 2011), particularly in areas where short-term sales are the norm, e.g. in second-hand car retailing (e.g. Brünner 1994). For sales personnel, this requires adaptations not only in terms of behaviour but also in terms of applied reasoning.

48.4.3 Social and Health Care

As in the sales and services industry, an important aspect of social competence in social and health-care work is the separation of emotional experience and emotional expression (Gieseke 2007). Unlike sales and services, however, genuinely felt emotion is often considered part of the social and professional identity of care workers (Briner 1999; Zapf 2002), and contrary to sales and service contexts, there is also some likelihood that authentic emotional expression will be tolerated in backstage vocational and professional working environments (Gieseke 2007).

Some further differences exist between social and health-care work on the one hand and work in the sales and services industry on the other. While to influence clients' emotions can be considered as a prerequisite of successfully carrying out work requirements in both cases, in care work contributions to emotional change on the part of the client is not just a means to selling products and services but is also an end in itself – to the extent that it can be even more important than physical healing, as is particularly the cases of care for the elderly, care for victims of fatal diseases or psychotherapy (Hacker 2006). Similarly, patient activation and participation are goals deemed central to care work (Street 2003, 915). Here, it is important to

note that contrary to Zapf's (2002) assumptions, this should not be seen in analogy to service work oriented at making customers feel good, like hostess work, where the ultimate goal is to influence customers to spend money in an enterprise. In the case of care work, the requirement to emotionally influence clients also makes it necessary to adequately assess their feelings. Zapf (2002) argues that '[to] be able to manage the client's emotions, the accurate perception of their emotions is an important prerequisite' (240). He further emphasises the empirically found correlation between 'sensitivity requirements' and 'emotion expression requirements'.

An important difference between both areas of service work should be noted. Whereas emotional expressions in the helping professions are likely to be constrained by professional requirements – which are in turn transmitted through vocational and professional education – such behaviour in sales and services is only guided by organisational demands (Rastetter 2008). Moreover, one may suspect that care work requires a greater array of emotional expression than other kinds of work (Zapf 2002). This assumption would require empirical scrutiny, however. As Wildemeersch et al. (2000) note for guidance and counselling, the professional challenge in this area consists of balancing standardisation, regulated by output demands, predetermined procedures, a tendency to reduce complexity and individualisation strategies, regulated by the demands of an authentic encounter and the readiness to deal with situational complexity and interaction partners' individuality.

A particular aspect of social and health care refers to the fact that these professions also require abstract thinking and a substantial amount of knowledge about age- and disease-related restrictions and impairments in client communication (e.g. Korpijaakko-Huuhka and Klippi 2008; Gülich and Lindemann 2010). Other than in sales and services, where information and communication deficits predominantly concern products or services to be sold, in the case of care work with specific groups of clients or patients, substantial professional knowledge is required with regard to the interaction process itself, such as interaction with children or with clients who suffer from dementia (Wittmann et al. 2014) or hearing loss (Deppermann 2012). This demonstrates that in addition to emotional perception and expression, factual knowledge forms an integral part of social interaction in these occupations and professions.

In a comparison of different occupations and professions, an important issue refers to the extent to which the specific behaviour is scripted in the form of cognitive schemata, as is typical for routine behaviour (Zapf 2002). According to empirical findings of Morris and Feldman (1997), such 'scripting' is likely to occur when occupational or vocational requirements are such that episodes of emotional display remain short, as in the case of hospital nursing. In the context of prolonged interaction in care work, however, the concept of 'emotional dissonance' in the care profession gains importance. As Zapf (2002) points out, emotional dissonance can be understood as an external requirement which varies considerably even within care work, for example, with regard to feelings of disgust between child nursing and old age care. In the medical profession, professional feeling rules often require moderate emotional display, while at the same time 'internal emotional neutrality' is

necessary to exercise one's work. It can be argued that the ambivalence of maintaining emotional detachment while displaying a certain level of emotional engagement in client interactions is a particular requirement of sociologically defined professions.

To sum up, the relationship between factual knowledge and socially interactive behaviour seems much more intertwined for care work than for sales and services. Client knowledge, both abstract and concrete, is an indispensable requirement for carrying out the task in many areas of care work, with individualised communication being the norm for competent social action.

48.5 Measurement of Social Competencies

As already mentioned, the occupational and professional sector is characterised by a clear lack of empirical research – despite substantial initiatives in this direction.

The evaluation of competencies, in particular for purposes of staff recruitment, feedback concerning work or the establishment of cooperative structures in the organisation of work, but also for the targeted enhancement of specific facets of social competence, requires a theory-based concept of the property to be evaluated. The current deficit in terms of accepted rules for measuring social competencies results from challenges and difficulties in defining the construct. As has been emphasised above, social competencies develop predominantly in interactive processes, depending on individual and situational characteristics. They represent latent dispositions which can only be captured through their manifestations in concrete situation. Hence, their measurement presumes that personal and situational aspects and their interactions have to be taken into account (cf. Maag-Merki 2005, 366).

A further difficulty stems from the fact that the interpretation of the obtained values normally is not related to a maximum as the desired state but to a range of possible values where the optimum is defined as a corollary of normative premises.

The currently available instruments for measuring social competencies are based upon different methodological approaches. Standardised inventories and self-ratings are frequently chosen, although the spectrum of covered properties is often rather narrow and specific. Self-ratings or self-reports of behaviour are usually applied in personnel selection and in the area of personnel development, in the context of performance feedback and in school-related and further education-related learning and assessment contexts. There are, indeed, quite a number of different psychometric scales available to measure specific dimensions such as assertiveness or cognitive and affective aspects of empathy, self-control, self-efficacy, locus of control and prosocial behaviour (see Schoon 2009, 5). However, the use of self-ratings and self-reports for the measurement of social competencies is rather controversial. In particular, concerns have been raised with respect to their construct and prognostic validity, their reliability and the likelihood of compliance effects (cf. Schoon 2009, 6; Maag-Merki 2005, 366). External observation of individual behaviour or assessment-centred techniques (Schuler 2007) may well generate valid and valuable

data pertaining to relevant occupational and professional situations, but drawing heavily on time resources.

Situational judgement tests may be interpreted as a compromise between self-ratings and external observations, although they in turn present problems as a consequence of their inherent multidimensionality with subsequent problems in terms of the quality of the measurement. Further problems derive from the fact that few of the existing instruments take the specificity of the investigated interactions into account. Focusing on learning strategies, Friedrich and Mandl (1992, 18) have named this the 'dilemma of scope versus precision', which seems to hold for the measurement of social competencies as well and which is exacerbated by unsettled issues concerning the functionality of domain specific as opposed to overarching/generic competencies. More recent approaches attempt to capture social competencies by way of computer-based measurement techniques. Here, stimuli consist of standardised occupational situations, e.g. by the use of video vignettes, followed by instructions to interpret the situation and to suggest a concrete course of action (cf. Wittmann et al. 2014). This computer-/video-based technique also permits to search answers to questions concerning the domain specificity of social competencies, as some of the situations presented as stimuli are bound to a narrow occupational context while others refer rather generally to cross-occupational contexts.

There is no point in denying, however, that a great deal of development still needs to be done, if objective, reliable and valid research instruments are to be obtained, in order to arrive at defensible psychometric models of social competence. Multi-method strategies may help to facilitate pragmatically useful, theoretically grounded process analyses.

48.6 Conclusions

The theoretical basis laid out in this chapter suggests the existence of a general, broadly transferable core of social competence pertaining to a wide range of vocational and professional social interaction. At the surface level, it entails the ability to adequately perceive and express messages both through verbal and nonverbal channels and to adapt to situations. Specific differences between the vocations and professions here investigated depend on the following factors:

1. The goals of social interaction.
2. The extent to which professional norms play a role and have to be balanced against organisational norms and rules.
3. The nature and relevance of factual knowledge about social interaction and the extent to which it is intertwined with what can be meaningfully described as social competence.
4. The degree in which the expression of emotion is expected or even required.
5. The existence and impact of vocation or occupation-specific scripts for institutionalised contexts where short-term interaction is the rule.

In dealing competently with emotion, a balance in handling the 'emotional dissonance' between external expectations and internal states and processes is an integral and essential part of social competence in vocations and professions, for which interaction with external clients or customers is constitutive. Yet the abovementioned deliberations also lead to the conclusion that in some respect the differences examined between the vocational and professional areas are quite substantial. The long-term vs. short-term nature of the communicative relationship specifically, the extent to which it is individualised and the fact that economisation has – at least as of now – not yet fully dominated the area of care work may be relevant distinguishing factors.

The differential development of social competence specific to the vocations or professions discussed here remains to be further clarified by empirical investigations. Another aspect which is in particular a need of future studies is the relevance of psychomotor skills and cognitive abilities for occupational and professional performance (Kanning 2002; Greene 2003). In particular, it appears promising to examine the open questions pertaining to the relationships between domain-specific and overarching competencies.

Apart from requirements for empirical research and improvements in measurement, the chapter warrants thoughts on policy- and curriculum-oriented questions. While, as demonstrated, a substantial body of research and empirical evidence exists in the field of social competence in vocational and professional education, it seems questionable that the differentiations and findings proposed in this chapter have made their way into policy considerations and vocational education curricula. Other than subject matter competencies, it seems likely that social competence is considered less accessible to sound theory and empirical research and that educational practice in schooling is guided either by generic ideas of social competence. But besides knowledge, specifically in vocational education, there may be another complication: features immanent to social interaction may prevent systematic theory-based treatment in vocational schools. There is some likelihood that, where, like in some areas of sales and services, ethical conflicts are prevalent but spaces for authentic emotional expression are lacking in the workplace environment, there will be little interest or tolerance for putting all features of domain-specific social interaction out in the open.

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Chapter 49
Computational Thinking as an Emerging Competence Domain

Aman Yadav, Jon Good, Joke Voogt, and Petra Fisser

49.1 Introduction

Wing (2006) posited computational thinking (CT) as a problem-solving approach that draws on concepts fundamental to computer science by "reformulating a seemingly difficult problem into the one we know how to solve, perhaps by reduction, embedding, transformation, or simulation" (p. 33). Hence, computational thinking involves decomposing problems, using algorithms to solve problems, and abstracting and automating the problem-solving approach. Even though computational thinking includes a "range of mental tools that reflect the breadth of computer science," Wing argued that CT represents "a universally applicable attitude and skill set everyone, not just computer scientists, would be eager to learn and use" (p. 33).

Though Wing's (2006) article popularized the term "computational thinking," Denning (2009) suggested that CT has a long history in computer science since the 1950s when it was known as "algorithmic thinking." Some aspects of algorithmic thinking approaches can be found in Polya's (1945) "How to Solve It." While working without the benefit of modern computing, Polya's work examined how everyday problems could be approached in a disciplined manner, decomposed into smaller problems, and solved using common techniques. More recently, Papert (1980, 1991) tied the practice of computer science to the act of thinking, which became a

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central theme of his work with the LOGO programming language. Papert saw the students' creation of "microworlds" in LOGO as an epistemological apprenticeship to help develop students' thinking and problem-solving abilities. Papert believed that the LOGO environment provided students with opportunities to program the computer, which "could contribute to mental processes not only instrumentally but in more essential, conceptual ways, influencing how people think even when they are far removed from physical contact with a computer" (Papert 1980, p. 4). In our preferred conceptualization of computational thinking, we are attempting to shift the focus from the programming tools to the actual thinking skills Papert's methods were hoping to enhance.

So what constitutes computational thinking? What are the different components of computational thinking? Wing (2008) proposed computational thinking as two As: choosing the right *abstractions* and *automation* of those abstractions. In particular, Wing argued that computational thinking is reformulating complex problems into one which we know how to solve using abstractions and decomposition. The Royal Society in the United Kingdom (2012) similarly described computational thinking as "the process of recognizing aspects of computation in the world that surrounds us, and applying tools and techniques from Computer Science to understand and reason about both natural and artificial systems and processes" (p. 29). Barr and Stephenson (2011) expanded on these ideas and proposed nine core computational thinking concepts and capabilities, which included data collection, data analysis, data representation, problem decomposition, abstraction, algorithms and procedures, automation, parallelization, and simulation.

These computational thinking ideas are fundamental parts of twenty-first century skills that are ubiquitous and can be applied across a wide range of fields. Wing (2006) argued that this new competence should be added to every child's analytical ability as a vital ingredient in the classroom given the pervasiveness of computational thinking in other disciplines, including statistics, biology, chemistry, and physics. Barr and Stephenson (2011) further asserted that given the importance of computing in the lives of students and how many of them will work in fields influenced by computation, it is critical that we begin to engage them in using algorithmic problem-solving and computational tools.

The following sections discuss key components of computational thinking competencies and how three countries (England, the Netherlands, and the United States) are addressing computational thinking in elementary and secondary classrooms. We also discuss the implications for those computational thinking competencies for vocational education and provide directions for future work in this area.

49.2 Three Country Cases

In this section, three cases of how national organizations in England, the Netherlands, and the United States are addressing the need for computational thinking in compulsory elementary and secondary education (i.e., K-12 schools) are presented.

49.2.1 Computing in the National Curriculum in England

In 2012, the Royal Society published a highly influential report with the title "Shut down or restart" about the state of computing in the UK schools. Computing was defined as a broad term and referred to information and communication technology (ICT) as it is used in schools and the use of information technology in the industry. The complaint expressed in the report was that ICT as a compulsory curriculum subject mainly focused on the acquisition of digital literacy, the general ability to use computers. The Royal Society argued that there is a need to also pay attention in the compulsory curriculum to information technology, the use of computers throughout society, including aspects such as the architecture of IT systems and human-computer interaction as well as computer science as an academic discipline that focuses on issues such as programming languages, data structures, and algorithms. For many students, computing was associated with low-level skills, because of the emphasis on digital literacy only. As a result, students did not have the opportunity to become interested in information technology or computer science as a potential area of interest for further studies, and only a few students continued their education in these fields. Without ignoring the importance of developing digital literacy skills in every child as a basis for being able to function in a society driven by digital technologies, the Royal Society argued for the recognition of information technology and computer science as important and foundational subjects in compulsory education. It was stated that "Every child should have the opportunity to learn concepts and principles from Computing (including Computer Science and Information Technology) from the beginning of primary education onward, and by age 14 should be able to choose to study toward a recognized qualification in these areas" (p. 44). In particular, they contended a high status for computer science, like other core subjects such as mathematics and history.

Core in England's computing curriculum is the importance attached to computational thinking. The definition of computational thinking the Royal Society adheres to emphasizes the importance of approaches, tools, and techniques from computer science to understand and reason about both natural and artificial systems and processes in the world around us. Computational thinking, in the view of the Royal Society, goes beyond computer science as a subject but is becoming part of many other disciplines and might even change other disciplines in a fundamental way. From an educational perspective, the following arguments support the need to position computer science as a core subject in the curriculum:

- Computer science develops key thinking skills in children: logical reasoning, modeling, abstraction, and problem-solving. Important aspects of computer science are the ability to be precise (a lack of precision makes a computer program fail and requires debugging) and the ability to break down a problem into subproblems and develop solutions for subproblems and interactions between these solutions.

- The ultimate goal of computer science is to create solutions for problems. It requires students to be creative, often in teams, and they need to apply "principles of quality, workmanship, fitness for purpose, and considerations of project management" (p. 29) to be able to solve complex computational problems.
- And finally, computation is a fundamental part of today's digital world. So for children to become an active participant in our society, they need to understand computing concepts to be able to contribute to highly sensitive societal issues involving computing, such as privacy and cyber criminality.

Based on the report of the Royal Society, England has commenced the implementation of a new compulsory curriculum for computing as of September 2014 for 5–16 year-olds. Although the new computing curriculum comprises three subdomains – computer science, information technology, and digital literacy – it is obvious that computer science forms a major part of the curriculum. The curriculum has four main goals (Department of Education 2013). All students should be able to:

- Understand and apply the fundamental principles and concepts of computer science, including abstraction, logic, algorithms, and data representation
- Analyze problems in computational terms and have repeated practical experience writing computer programs in order to solve such problems
- Evaluate and apply information technology, including new or unfamiliar technologies, analytically to solve problems
- Act as responsible, competent, confident, and creative users of information and communication technology

The national curriculum in England has four key stages: Key Stage 1 (5–7-year-olds), Key Stage 2 (7–11-year-olds), Key Stage 3 (12–14-year-olds), and Key Stage 4 (14–16-year-olds). We focus on the CT competencies that are part of the new computing curriculum (based on the elaboration of the curriculum by Naace and CAS 2014).

In Key Stage 1, students become acquainted with simple algorithms (e.g., recipes, describing the way home) and use simple programming tools to develop algorithmic notion (e.g., using LOGO or similar programs). Students should understand that there are many algorithms to solve real-world problems and learn to understand the advantage of using good algorithms. Students should also be encouraged to apply logical reasoning (in terms of cause/effect) instead of simply guessing and be able to create and manipulate digital content with the idea that students have control over their own digital product, and that this can be done in several ways.

In Key Stage 2, students learn how to design, write, and debug programs for diverse contexts using visual or graphical environments and to understand basic structures of computer programs (sequence, selection, and repetition) with the help of flow diagrams. They also need to understand what inputs and outputs are and how they can be used in controlling or simulating physical systems, such as programmable toys. Students at this age need to understand what a variable is and what the effect is when changing a variable in a program or a simulation. To further their logical reasoning skills, students need to be able to explain how simple algorithms

work, regardless the starting situation. They also need to develop a basic understanding of computer networks.

In Key Stage 3, students have to design, use, and evaluate computational abstractions that model the state and behavior of real-world problems, because in this way it becomes clear that computation provides concrete insights in natural and artificial systems. In addition, they need to further their understanding that there are often several algorithms that can solve the same problem and need to be able to compare different algorithms on a variety of indicators (e.g., efficiency, flexibility, generalization). Furthermore, students need to become acquainted with at least two programming languages (of which one is textual) and learn to use appropriately data structures and procedures. In addition, they develop a more in-depth understanding of how computers work and how they communicate with each other. Finally, they experience the interconnected nature of the different aspects of computing through the use of extended projects, extending the knowledge and skills developed at Key Stage 2.

Finally, attention for computing is still compulsory in Key Stage 4, but the content is less prescriptive. The rationale is that students should be able to make an informed choice to further specialize in different aspects of computing. Students may either choose to prepare for academic routes or for continuation in vocational education. Also when they do not plan to continue studies in computing, they need to get the opportunity to further develop the creativity, capability, and knowledge acquired in the previous key stages. The ultimate aim is to provide students with opportunities to continue studies in the field of computer science or to continue in a professional career.

49.2.2 Computational Thinking in the Netherlands

Currently, there is no official national policy in relation to computational thinking in the curriculum of the Netherlands, and CT does not have an explicit position in the Dutch curriculum. The Royal Netherlands Academy of Arts and Sciences (an advisory body to the Dutch government) published a report on digital literacy in 2013, which caused much discussion in the Netherlands. The Academy referred to digital literacy as the ability to make prudent use of digital information and communication and to evaluate the consequences of that use critically (Lenstra et al. 2012). They consider computational thinking as part of the digital literacy skills along with critical thinking skills when using Information and Communication Technologies (ICT), and applying (ethical) rules when using ICT, including notions of privacy and security. The Academy related digital literacy to general secondary (havo) and pre-university (vwo) levels and concludes that information science and informatics as subjects have a marginal status in the current curriculum, their quality insufficient, and their content outdated. They argued that the current teaching of digital information and communication in secondary schools should be completely revised;

otherwise, the Netherlands will lag behind. The Academy made four recommendations to the Minister of Education, Culture and Science:

(a) Introduce a new compulsory subject information and communication in the lower years of havo and vwo, as a broad and compact introductory subject, covering the essential facets of digital literacy
(b) Completely redesign the optional subject informatics in the upper years of havo and vwo
(c) Encourage interaction between these subjects and other school subjects
(d) Make it a priority to raise a new generation of teachers with new skills and attitudes

The Academy's report led to discussions on several issues, including whether digital literacy (and thus CT) should only be part of informatics and whether digital literacy was equally important in prevocational and primary education. Based on the report of the Academy, the Dutch Ministry of Education asked the Netherlands Institute for Curriculum Development to carry out two studies: one on the outdatedness of the subjects information science and informatics and another broader study on the twenty-first century skills, of which computational thinking can be seen as a critical aspect.

The intention of the study on the current state of information science and informatics was to see whether the current upper secondary school teachers that teach information science and/or informatics agreed that these subjects were outdated. Looking at the results related to CT, the study concluded that teachers did not think there was enough attention to CT as a thinking skill, and also that there was not enough time allocated in the curriculum to teach computational thinking skills (Tolboom et al. 2014). The teachers did see opportunities in the current curriculum, but many indicated that CT should have a more explicit position in the curriculum and that CT should be part of teacher training and professional development programs.

The second study (Thijs et al. 2014) was carried out in the context of primary and lower secondary education to examine whether twenty-first century skills were currently part of the formal curriculum (the core objectives for all subjects that should be taught at school and the common framework of reference for language and mathematics), the intended curriculum (analyzed by studying existing learning materials), and the implemented curriculum (analyzed through a questionnaire for teachers and case studies in schools). Computational thinking was seen as a subskill of digital literacy (one of the twenty-first century skills). The results suggested that teachers in primary and lower secondary education were familiar with twenty-first century skills and found it was important to pay attention to it; however, it got the least attention. CT at primary schools was almost nonexistent, except for a small number of schools that experimented with programming languages. Some attention to CT was paid in lower secondary schools, but compared to other twenty-first century skills, it scored very low. The case studies exhibited that even though teachers

were familiar with the twenty-first century skills, the intentions to do something in their classroom lacked focus. Thijs et al. (2014) concluded that to support teachers in integrating these skills in their teaching practice, four types of support were important: curriculum development (specification of the skills in the curriculum and exemplary teaching materials), testing instruments (development of useful frameworks and tools for monitoring and assessing the pupils), professional development (wide range of professional development activities and networks of school for knowledge sharing), and more learning resources (more attention to the skills in regular teaching materials and a broader access to additional open learning materials). It is also recommended that all twenty-first century skills become more visible in the nationwide curriculum framework, including CT.

Even though computational thinking does not have an explicit position in the Dutch curriculum, the Academy's report in 2013 and the subsequent studies in 2014 helped shape the discussion on this subject. Recently a national curriculum debate on the rationale, aims, objectives, and content of education has started in the Netherlands. The main question during this debate is: "What knowledge is most important to learn in basic education, and why/for what purpose?" It is believed that computational thinking and digital literacy will be an important part of this discussion.

49.2.3 USA: Fostering CT in K-12

In the United States, the CS principles course curriculum framework for high school students has been developed to expose K-12 students' computational thinking competencies. The framework proposed six computational thinking practices to "help students coordinate and make sense of knowledge to accomplish a goal or task" (College Board 2014, p. 2). The six computational thinking practices include:

- *Connecting Computing*: This CT practice relates to the influence of computing and its implications on individuals and society. Students are expected to:
  - "Identify impacts of computing;
  - Describe connections between people and computing; and
  - Explain connections between computing concepts" (College Board, p. 4).
- *Creating Computational Artifacts*: Given the creative nature of computing, this practice allows students to engaging in computing by designing and developing computational artifacts. Students are expected to:
  - "Create an artifact with a practical, personal, or societal intent;
  - Select appropriate techniques to develop a computational artifact; and
  - Use appropriate algorithmic and information-management principles" (College Board, p. 4).

- *Abstracting*: The third CT practice of the course focuses on students' understanding and applying abstraction "to develop models and simulations of natural and artificial phenomena, use them to make predictions about the world, and analyze their efficacy and validity" (College Board, p. 4). Students are expected to:
  - "Explain how data, information, or knowledge is represented for computational use;
  - Explain how abstractions are used in computation or modeling;
  - Identify abstractions; and
  - Describe modeling in a computational context" (College Board, p. 4).
- *Analyzing Problems and Artifacts*: Computational thinking also involves developing solutions, models, and artifacts for problems as well as evaluating the appropriateness of the proposed solutions and artifacts. Students are expected to:
  - "Evaluate a proposed solution to a problem;
  - Locate and correct errors;
  - Explain how an artifact functions; and
  - Justify appropriateness and correctness" (College Board, p. 5).
- *Communicating*: The CS principles course proposed communication (both written and oral) as an important CT practice that allows students to describe the influence of technology and computation supported by data visualizations and computational analysis. Students are expected to:
  - "Explain the meaning of a result in context;
  - Describe computation with accurate and precise language, notations, or visualizations; and
  - Summarize the purpose of a computational artifact" (College Board, p. 5).
- *Collaborating*: Finally, collaboration is a key CT practice, where peers learn to work together effectively to solve ill-structured problems that use computation. Students are expected to:
  - "Collaborate with another student in solving a computational problem;
  - Collaborate with another student in producing an artifact;
  - Share the workload by providing individual contributions to overall collaborative effort;
  - Foster a constructive collaborative climate by resolving conflicts and facilitating the contributions of a partner or team member;
  - Exchange knowledge and feedback with a partner or team member; and
  - Review and revise their work as needed to create a high-quality artifact" (College Board, p. 5).

As can be seen from these three cases, there is no consensus definition of computational thinking, and what comprises computational thinking competencies is not agreed upon. For example, both the national curriculum in England and the CS principles course curriculum framework have overlapping CT concepts (such as abstraction, algorithms, and data representation) but also include different aspects

of what makes up as core computational thinking practices (such as communication and collaboration). While some of these practices are specific for the work of a computer scientist, others are general competencies relevant in many professional domains. Given the differences within the field on mechanisms to incorporate computational thinking in the classroom, the competencies model (See Koeppen et al. 2008) may prove useful in examining what we hope students learn. Specifically, Koeppen and colleagues suggested that competencies are context-specific cognitive dispositions that play a key role in addressing problems and tasks in specific domains. Computational thinking competencies could be developed in specific subject areas in primary and secondary education.

49.3 Computational Thinking Competencies

Recently there has been an increased focus on developing competencies for students that focus on real-world problem-solving abilities and go beyond measuring more general cognitive abilities (Koeppen et al. 2008). However, even though the concept of development competencies has enjoyed an increased currency in education, defining it has proved to be challenging as there are a number of fundamentally different concepts of competence (Klieme et al. 2008). Researchers have suggested that Chomsky (1965) introduced the idea of competence to describe the cognitive system underlying the linguistic abilities necessary to produce speech (Klieme et al. 2008). Weinert (1999) suggested that there are nine different ways of defining competence, including "(a) general cognitive ability; (b) specialized cognitive skills: (c) competence-performance model: (d) modified competence-performance model: (e) motivated action tendencies: (f) objective and subjective self-concepts: (g) action competence: (h) key competencies: (i) metacompetencies" (p. 6). From these definitions of competencies, Klieme, Hartig, and Rauch suggested a working definition of competencies as "context-specific cognitive dispositions that are acquired by learning and needed to successfully cope with certain situations or tasks in specific domains" (p. 9). Competence, thus, refers to both action and development, implying that every person is able to act in a specific situation, but that the nature of action is determined by the actor's (professional) biography and can be developed. This definition of competence is appropriate not only within the school context but also in the context of the future workplace.

Within this framework of competencies (as cognitive dispositions) which are necessary to solve ill-structured problems, computational thinking fits in nicely. We concur with others that computational thinking consists of problem-solving that utilizes approaches on which computer scientists heavily rely (Grover and Pea 2013; Yadav et al. 2014). We argue that computational thinking requires students to develop both domain-specific and general problem-solving skills (see also Neubert et al. in this volume for a more detailed elaboration of domain-specific and general problem-solving skills). A core issue in this respect is how to separate the cognitive activity of computational thinking from the action of merely working on a computer

or another digital device. For instance, word processing and/or creating webpages do use digital technologies; however, these do not necessarily involve the kinds of conceptualization unique to computational thinking. The EDUsummIT 2013 working group on computational thinking (Mishra et al. 2013) argued that computational thinking needed to be more than learning to program and that the application of computational thinking needs to be seen in diverse fields. An important aspect of CT was seen as the ability to augment human capabilities by learning to "manipulate" the abilities of digital technologies and beyond that to identify the appropriate technical and physical tools and understanding in how to apply multiple tools in appropriate ways to solve problems and/or develop solutions in a person/tool partnership. So how do we develop such computational thinking competencies in children and youth?

49.4 Developing CT Competence in Education

In the USA, the Computer Science Teachers Association (CSTA) and International Society for Technology in Education (ISTE) established a steering committee focused on developing not only a definition of computational thinking suited for K-12 but also how CT would manifest in the K-12 curriculum (Barr and Stephenson 2011). The committee proposed a framework for incorporating computational thinking using the nine concepts and capabilities across the disciplines from computer science to language arts in compulsory primary and secondary education settings. For example, the core computational thinking concepts and capabilities could be practiced in language arts classrooms by identifying patterns for different types of sentences (data analysis), writing an outline (problem decomposition), using similes and metaphors (abstraction), and writing instructions (algorithms). Similarly, the authors also described how the nine CT core ideas could be highlighted in secondary science classrooms, including collecting, analyzing, and summarizing data from experiments (data collection, data analysis, and data representation), building models of physics entity (abstraction), and simultaneously running experiments with different parameters (parallelization). See Barr and Stephenson for specific ideas on how to embed core CT concepts in math, science, social studies, and language arts that do not necessarily focus on programming. The key to successfully embedding these computational thinking capabilities (or competencies) requires that both students and teachers utilize CT vocabulary when describing problems and solutions (Barr and Stephenson 2011). Members of the committee also discussed a number of predispositions and dispositions as being essential dimensions of CT. Some of these dimensions included confidence in dealing with complexity, persistence in working with difficult problems, having a tolerance for ambiguity in dealing with open-ended problems, and the ability to work in collaborative groups toward a common goal. While we agree that these are key aspects of computational thinking, there is a risk of diluting the very essence of computational thinking,

making it too vague and broad and indistinguishable from other twenty-first century skills.

While the CSTA and ISTE frameworks provide a broad basis for implementing CT in the classroom, Grover and Pea (2013) argued that programming is a key tool to support cognitive tasks related to computational thinking competence. They proposed the following computational thinking elements that could form the basis for curriculum: "(a) Abstractions and pattern generalizations (including models and simulations); (b) Systematic processing of information; (c) Symbol systems and representations; (d) Algorithmic notions of flow of control; (e) Structured problem decomposition (modularizing); (f) Iterative, recursive, and parallel thinking; (g) Conditional logic; (h) Efficiency and performance constraints; (i) Debugging and systematic error detection" (p. 39–40). Similarly, the National Research Council (NRC 2010) report on the scope and nature of computational thinking suggested that computational thinking is just another language (in addition to written and spoken language, science, and mathematics) that can be used to talk about the complex processes within the universe. Mitch Resnick, a member of the NRC committee, argued that "…computational thinking is more than programming, but only in the same way that language literacy is more than writing. They are both very important. Yes, it's more, but don't minimize programming just because it's more… programming, like writing, is a means of expression and an entry point for developing new ways of thinking" (NRC 2010 p. 13).

The idea of programming to support computational thinking goes beyond just coding and syntax and includes problem decomposition and algorithmic thinking. Another NRC (1999) report defined programming as "the construction of a specification (sequence of instructions or program) for solving a problem by an agent other than the programmer… [Programming] entails decomposing the problem into a sequence of steps and specifying them sufficiently precisely, unambiguously, and primitively that the interpreting agent, usually a computer, can effectively realize the intended solution" (p. 42). We agree with this view of programming, which can include giving few commands (such as giving directions to get from Point A to Point B, making a peanut butter and jelly sandwich, etc.) to writing complex programs that can be executed by an agent (i.e., computer – mechanical or human).

A number of programming and computational tools can help support the development of these computational thinking competencies across the K-12 schools. Grover and Pea (2013) have argued that such environments need to have a "low floor, high ceiling" that allows beginners to dive into the programming environment without frustration, but also should provide enough depth to meet the needs of advanced students. NRC (1999) stated that two conditions are critical to programming – "precisely and primitively."

- "Precise" specifications are essential to provide assurance that the agent can determine which actions are to be performed and in what order, so that the intended result is achieved. Avoiding ambiguity is obviously crucial, but even seemingly unambiguous commands can fail. For example, "turn right" fails if the soccer players can approach the intersection from either the east or the west, so

"turn north" is preferred. Similarly, "beat" and "fold in" are not synonyms for "stir" when combining ingredients, so successful recipes use precise terminology selected with great care. An important non-technology advantage of programming knowledge is that the need for precision can promote precision in everyday communication.

- "Primitive" specifications are essential to provide assurance that the steps to be performed are within the operational repertoire of the executing agent. The programmer may understand the task as "pi times R squared," but if the executing agent doesn't know what "squared" means or how to accomplish it, then the programmer must express the task in more primitive terms, perhaps revising it to "pi times R times R." For many taxpayers, the word "qualifying" in the instruction phrase "subtract qualifying contributions" would likely fail the test for primitiveness, because they would not readily understand what the term means (p. 42–43).

A number of tools make programming accessible to students from elementary school (e.g., Scratch Jr, Hopscotch, Kodable, and Alice) to high school (e.g., App Inventor and Python). These tools promote continual use of abstract and algorithmic thinking, which are valuable skills for approaching problem-solving in one's discipline (NRC 1999).

However, as pointed out previously computational thinking is not just limited to using programming tools as the Computer Science Teachers Association (CSTA) CT teacher resource highlights. The CSTA teacher resource provides specific CT concepts and their operational definition as well as exemplars that teachers could adapt from across elementary, middle, and high school grades in multiple content areas. The teacher resource documents also include prototype learning experiences called Computational Thinking Learning Experiences (CTLEs) that resemble a lesson/unit plan. The CSTA computational thinking documents can be accessed at http://csta.acm.org/Curriculum/sub/CompThinking.html. Yadav et al. (2016) also provided some specific examples of computational thinking that could be embedded in secondary schools and that span across multiple content areas including math, science, social studies, and language arts.

49.5 Implications for Vocational Education

"Every child should have the opportunity to learn concepts and principles from Computing (including both Information Technology and Computer Science) from primary school age onwards, and by age 14 should be able to choose to study towards a recognised qualification in these areas" (Royal Society 2012, p. 31). This argument from the Royal Society is a major reason that current policies and practices around the world, not only in England, emphasize to focus on CT in secondary education; however, that attention for CT in vocational education is mostly lacking. The examples of how CT is perceived as a curriculum issue in England, the

Table 49.1 Levels distinguished in the problem-solving in technology-rich environments test used in PIAAC (OECD 2013)

Level 1:
Adults can complete tasks in which the goal is explicitly stated and for which the necessary operations are performed in a single and familiar environment. They can solve problems in the context of technology-rich environments whose solutions involve a relatively small number of steps, the use of a restricted range of operators, and a limited amount of monitoring across a large number of actions
Level 2:
Adults can complete problems that have explicit criteria for success, a small number of applications, and several steps and operators. They can monitor progress toward a solution and handle unexpected outcomes or impasses
Level 3:
Adults can complete tasks involving multiple applications, a large number of steps, impasses, and the discovery and use of ad hoc commands in a novel environment. They can establish a plan to arrive at a solution and monitor its implementation as they deal with unexpected outcomes and impasses

Netherlands, and the United States, described earlier in this chapter, also show that CT is often seen as a part of the broader domain of digital literacy. In these three examples, digital literacy is recognized as an important twenty-first century competence domain, as has also been emphasized by the European Union (2007) and the OECD (2005). Digital literacy not only incorporates CT but also information literacy and computer literacy skills (Thijs et al. 2014; Voogt and Pareja Roblin 2012). Thus it is useful to explore whether it is needed to pay attention to digital literacy in vocational education and training (VET).

In the frame of the Programme for the International Assessment of Adult Competencies (PIAAC), the OECD assessed the problem-solving skills in technology-rich environments of 16–65-year-olds in 24 countries (OECD 2013). Problem-solving in technology-rich environments was defined as "the ability to use digital technology, communication tools and networks to acquire and evaluate information, communicate with others and perform practical tasks" (OECD 2013, p. 86). The results of this study exhibited that most adults scored at the lower levels of the scale with 29.4 % scoring on level 1, 28.2 % on level 2, and only 5.8 % of the adults score on level 3 (Table 49.1 provides a description of these three levels). Although the 16–2-4year-olds scored a bit higher on level 3 (9 %), it was still low compared to levels 1 and 2 (32.4 % and 41.7 %, respectively). Quite a large number of adults could not be classified because they were not able to take the test or their basic qualifications for taking the test were too low.

Hämäläinen et al. (2014) further analyzed the PIAAC data for 11 European countries particularly focusing on adults with a VET qualification. Their findings showed that within and between the countries large differences existed in the ability of VET adults to solve problems in technology-rich environments. Although the countries differed in their VET systems, either school-based or workplace-based, no systematic differences in scores related to these two VET systems could be observed. In all countries, VET trained adults scored significantly lower on the test than adults

with at least an upper secondary education degree. In five of the eleven countries studied, adults with a VET qualification scored lower than adults with at least a lower secondary education degree. The authors concluded that additional studies are required to better understand how learning VET experiences can prepare people for the needs of twenty-first century workplaces. As Hämäläinen et al. (2015) argued "we need new ways to enhance the quality of problem-solving in technology-rich environments to respond to the needs of working life and to empower VET adults' professional development" (p. 46).

These results suggested that attention for digital literacy is not only an issue for discussion related to the secondary education curriculum, but that digital literacy should also be discussed in the realm of VET. The PIAAC study demonstrated that many adult learners are at risk when they need to solve problems in technology-rich environments and adults with a VET qualification even more. We argue that computational thinking as an inseparable part of a digital literacy should also be an important competence domain within VET. Given the role of computing in the (working) life of today's citizens, the competence to solve problems in technology-rich environments is of paramount importance.

49.6 Conclusions

In summary, we agree with the views of the NRC (2010) and the Royal Society (2012) that computational thinking is a broadly applicable competence domain, which is important for individuals to be successful in today's technological society, to increase interest in information technology, and to support inquiry in other disciplines. Furthermore, attention for CT in compulsory education also leverages the opportunity for students to become interested in information technology or computer science as a potential area of interest for further studies or a future career. Given that computational thinking has been highlighted as an ubiquitous twenty-first century skill and the emphasis placed on the need to embed CT in primary and secondary schooling, we need to focus on better understanding how computational thinking tools support learners. The three cases of computational thinking in England, the Netherlands, and the United States provide a good starting point to incorporate; however, we need to carefully examine the role of computational thinking across a number of fields that go beyond the use of programming. The first step in this direction might be to agree upon a definition of computational thinking or at the very least to establish a common understanding of essential CT constructs that are relevant across disciplines. Such an effort would allow educators and researchers to focus on how different CT constructs relate to their disciplines and embed them in their own work. Barr and Stephenson (2011) provide a good framework on how computational thinking applies to different subject areas, but this needs to be expanded to include examples that educators can easily adapt in their classrooms. Additionally, there is a need to pay attention to CT as part of the broader concept of digital literacy in vocational education and training, as otherwise adults with

only a VET qualification may not be well prepared for the working life in the twenty-first century.

Furthermore, there is a need to focus on teacher preparation and professional development, both at the preservice and in service levels, to prepare educators to see the relevance of computational thinking to their own teachings. At the in service teacher level, we need professional development workshops that engage teachers in incorporating computational thinking in their specific subject areas rather than generic workshops that only provide a general view of computational thinking. At the preservice teacher level, one possibility is to infuse computational thinking modules into teaching methods courses to allow teacher education students to see the applicability of CT concepts to their brand of study. Yadav and colleagues (2014) found that embedding a one-week computational thinking module in a teacher education program has the potential to significantly improve preservice teachers' CT competence in general.

Finally, implementing computational thinking needs to go hand in hand with a research agenda that examines whether CT activities have the desired influence on student outcomes. However, this is challenging work as there are few valid and reliable measures that assess computational thinking without the use of programming tools. Currently, there is also limited research on how computational thinking is manifested in fields other than computer science (e.g., Sengupta et al. 2013; Wolz et al. 2011). Hence, rigorous measures need to be developed that are based upon specific computational thinking constructs, which could be used to assess CT in the context of specific subject areas in all education, including vocational and professional education and training.

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Part V
Conclusions and Discussion

Chapter 50
Competence Theory and Research: A Synthesis

Martin Mulder

50.1 Introduction

The parts and chapters in this volume illustrate the fact that competence-based vocational and professional education is a worldwide innovation. Part I showed that there are many conceptual foundations and theoretical perspectives and that various authors have different views on the pros and cons of competence-based vocational and professional education. Especially Part II contains contributions from all parts of the world, like America, Europe, Asia and Africa. Chapters from Australia are included in Part I. Part III showed that the competence-based education philosophy cuts across many key aspects of education systems, such as the use of competence frameworks for curriculum development, the recognition of prior learning, quality improvement and effectiveness measurement, the areas of learning and the fields of knowledge and skills, as well as teacher support, teaching and learning. Part IV showed that the competence movement entered practically all subject matter domains in vocational and professional education.

The volume has also shown the features of competence-based education. These are:

1. The availability of a competence framework which specifies the competencies which are required for effective performance in an occupation or job (e.g. the chapter of Perrenet et al.).
2. A framework to assess the current level to which an educational programme is competence-based and to facilitate the decision-making process regarding the

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quality improvement of the programmes in the direction of CBE (e.g. the chapter of Wesselink et al.).
3. A strategy for revising existing curricula in the direction of CBE, with sufficient attention for the integration of theory and practice (e.g. the chapter of Gessler).
4. Measures to make competence-based learning attractive, such as by gamification, and profound, such as by supporting argumentation competence development (e.g. the chapters of Sailer et al. and Noroozi et al.).
5. Measures to enhance self-regulated learning in CBE (e.g. the chapter of Nokelainen).
6. A system for the assessment of prior learning, which can measure the competencies a candidate for a training, education or development programme already masters; such an assessment should lead to a personal study advice and where possible and appropriate lead to exemptions from certain classes or courses (e.g. the chapter of Bohlinger).
7. A system for formative competence assessment, to monitor competence growth, and a system for valid and trustworthy authentic summative assessment, to test the actual mastery of the key competencies for a job or occupation of the candidate (e.g. the chapter of Van der Vleuten et al.).
8. An instrument for the laddering of competencies across several education levels to distinguish the meaning of those competencies at these different levels (e.g. the chapter of De Jong et al.).
9. A system of mature competence management for the directors, managers, teachers and support staff in the organisation, with adequate competence feedback and development instruments (e.g. the chapter of Runhaar).This chapter will give further recent examples of developments in competence-based vocational and professional education. It will then answer the questions regarding this innovation which were raised in Chap. 1. Next, common misunderstandings about competence-based education are discussed. Subsequently, further research for competence-based vocational and professionals education is presented. Next, further observations and comments are given, after which the final conclusions of this volume are formulated.

50.2 Competence-based Education: A Global Innovation

This volume shows that the competence movement is more alive than ever. Not only are the member states of the European Union using this educational philosophy, countries in the Americas, Australia, Asia and Africa are also working with it for the development of their national qualifications frameworks, their curriculum design and assessment practice. During the last 10 years, and even today, there have been and still are many new competence-based initiatives in vocational and professional educational policy-making and competence framework building. There are many examples of this.

50.2.1 European Union

First of all, in 2006 the EU defined eight key competencies (or competences; as has been said in Chap. 1, the European Commission uses the spelling 'competences' instead of competencies) (http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=URISERV:c11090&from=EN), which are (1) communication in the mother tongue, (2) communication in foreign languages, (3) mathematical competence and basic competences in science and technology, (4) digital competence, (5) learning to learn, (6) social and civic competences, (7) sense of initiative and entrepreneurship and (8) cultural awareness and expression. The Commission stated that the key competencies are interdependent and they include '…critical thinking, creativity, initiative, problem solving, risk assessment, decision taking and constructive management of feelings'.

Next, in 2008 this was followed by the Communication of the Commission 'Improving competences for the 21st Century: An Agenda for European Cooperation on Schools', which reiterated the Commission's focus on key competencies. The Communication proposed to 'increase levels of reading literacy and numeracy…, reinforcing transversal as well as subject-based competences, particularly learning-to-learn; and adopting a comprehensive approach to competence development, encompassing curricula, learning materials, teacher training, personalised learning, and assessment techniques' (op cit, p. 7).

In the 'Synthesis Report on Peer Learning Activities in 2007' from 2008, being part of the Education and Training 2010 Work Programme of the European Commission, the first lessons were shared on the status of key competences in member states' lifelong learning strategies and curricula, referring to that as a change of educational paradigm, on the challenges schools were facing regarding the introduction of key competencies, and on support measures which could be used by schools to implement a competence-based education approach.

The theme of key competencies was followed up in the Education and Training 2020 work programme of the EC. As part of this programme, the thematic working group on 'assessment of key competences' published a literature review, with a glossary of terms and examples of assessment practice (http://ec.europa.eu/education/policy/school/doc/keyreview_en.pdf).

In another working document of 2012, the commission published policy guidelines on the assessment of key competencies in initial education and training (http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52012SC0371). Interesting to see is that the authors of this document define key 'competences' as '…a combination of knowledge, skills and attitudes appropriate to a specific context'. This definition is in line with the definitions given in Chap. 1, but different from how competence is defined in documents regarding the European Qualifications Framework, where 'competences' are seen as juxtaposed to knowledge and skills.

Currently, the theme of key competencies is included in the 2015 Riga Conclusions (http://ec.europa.eu/education/policy/vocational-policy/doc/2015-riga-conclusions_en.pdf). These conclusions are on the new medium-term deliverables in vocational education and training policy-making until the year 2020. These

deliverables are a follow-up of the review of the deliverables which were set out in the Bruges Communiqué of 2010. Key competencies are mentioned in the fourth policy option to '…further strengthen key competences in VET curricula and provide more effective opportunities to acquire or develop those skills through I-VET and C-VET' (op cit, p. 9), which are initial and continuing vocational education and training. The Riga Conclusions suggest quite wide opportunities for key competencies as policy option. According to the Conclusions, 'Concrete actions could, for example, include assessing the place of key competence in VET curricula, work on improving levels of basic skills of VET students as exemplified by PISA and PIAAC, strengthen provision of key competencies in VET, particularly in work-related training, promote innovative approaches to provide combined key competencies and work-specific skills, devote special attention to the development of entrepreneurial skills, etc.' (op cit, p. 9).

50.2.2 Sectoral Initiatives

Next to the generic European key competence agenda, there are also initiatives by sector organisations which are focused on certain competence domains, such as information and communications technology (ICT) (CEN 2014). Developed by CEN, the European Committee for Standardization and published in 2014, the e-Competence Framework 3.0 (http://www.ecompetences.eu/) is developed to map the competencies for ICT jobs. The e-Competence Framework defines competence as '…a demonstrated ability to apply knowledge, skills and attitudes for achieving observable results', which is similar to the definition given by Cedefop (2014 p. 47): 'The ability to apply learning outcomes adequately in a defined context (education, work, personal or professional development)'. The e-Competence Framework distinguishes 40 competencies defined on five mastery levels and is developed to give a transparent picture of what is needed in ICT professions in organisations in the private and public sector.

Another example of a sectoral competence framework is the European Qualification Standards for Logistics Professionals, developed by the European Logistics Association (ELA 2014). Developed and agreed by the logistics industry, this competence framework (http://www.elalog.eu/elaqf-qualification-standards) also pictures the needs of professionals to be able to deliver effective workplace performance. The standards included in the framework are outcome based and the foundation for competence assessment. As in any accreditation of prior learning programme, the assessment is conceived of as being independent from education trajectories.

50.2.3 Beyond the European Union

There are also examples of competence work beyond Europe, such as the OECD competency framework (OECD 2014). The Organisation for Economic Co-operation and Development (OECD) applied a competence approach to map the competence requirements of its own staff (http://www.oecd.org/careers/competency_framework_en.pdf). The OECD categorises its jobs in three broad families: (1) executive leadership; (2) policy research, analysis and advice; and (3) corporate management and administration. All jobs need certain competencies, and these are divided into technical competencies and core competencies. Technical competencies are specific for a certain job, whereas core competencies are the capabilities that are relevant in all jobs within the organisation, although their importance may vary by job. There are 15 core competencies, divided in delivery-related, interpersonal and strategic competencies. The delivery-related competencies are aimed at achieving results and are analytical thinking, achievement focus, drafting skills, flexible thinking, managing resources and teamwork and team leadership. The interpersonal competencies are aimed at building relationships and consist of having a client focus, diplomatic sensitivity, influencing skills, negotiation skills and organisational knowledge. The strategic competencies are aimed at planning the future and comprise of developing talent, organisational alignment, strategic networking and strategic thinking. For all core competencies behavioural indicators are defined at five job levels. Level one includes jobs like assistants, operators and secretaries, whereas level five includes heads of departments, counsellors, deputy directors and directors.

The United Nations Development Programme (UNDP) also includes policy recommendations in the direction of competence-based education. In the 2015 contribution to the United Nations Economic and Social Council (ECOSOC), it recommended

> …provision of appropriate learning quality, skills development and education-to-work transitions is critical in order to establish strong links between education and employment outcomes, particularly for youth. This can be accomplished through the establishment of a competency-based system for training and retraining in the short to medium term to increase the coverage and scope of formal economy-sector led education and training programmes and through partnerships with employers. This will enable the poor to access jobs in higher productivity sectors with increased wages in the longer term (ECOSOC 2015).

Another United Nations organisation, the International Labour Organization (ILO), also implements competence-based education initiatives, such as in the competency-based technical-vocational education and training (TVET) project in Bangladesh (ILO 2012). This project was part of the TVET reform which was initiated by the Bangladesh government.

Individual countries are also active in implementing competence-based education, such as Ethiopia, which is revising its higher education curricula, using principles for modular education (HESC 2013). It is remarkable that this TVET policy document contains much of the thinking of what has been named in Chap. 1 as

'functional behaviourism'. It seems as if the newer waves of conceptualising competence-based education have not entered the debates in TVET policy development in this case.

UNEVOC is supporting TVET reform in many developing countries, and competence-based education is one of the themes this organisation promotes. Wahba (n.d.) developed competence standards for TVET, and via the search engine of UNEVOC, many examples of implementing competence-based TVET initiatives can be found (see http://www.unevoc.unesco.org/gosearch.php?ie=UTF-8&q=competence-based&hl=en&sa=ok).

50.3 Answers to the Questions in This Volume

In Chap. 1 eight questions were listed which were thought to be relevant to discuss. Answering these questions should help to advance the field of competence-based vocational and professional education. The parts and chapters of this volume offer a wealth of information to address the questions, which will be done in this section. The questions were:

1. What are the key drivers for the competence movement and competence-based education?
2. What are the key dimensions by which conceptions of competence differ? What are the theoretical backgrounds and origins?
3. Are international and national policy debates on the competence-based education agenda sufficiently focused and coherent?
4. What is the value added of competence-based education for increasing the alignment of education and the world of work and the transition of graduates into (self-)employment?
5. What is the role of competence frameworks and standards in the redesign of vocational, professional and higher education programmes?
6. Which models for competence assessment are helpful for the measurement of student achievements in vocational, professional and higher education programmes?
7. What are distinct regional/national approaches of competence-based education and development (the UK, Continental Europe, the USA, Australasia, Africa)?
8. What is the state of research regarding competence-based vocational, professional and higher education and what outcomes can be reported?

These questions will be answered in the following sections.

1. **Key drivers for the competence movement and competence-based education**

There is one major driver of the competence movement, which is to align education with the world of work. Labour market needs – or more generally, societal needs – are very often mentioned as being relevant for educational planning and curriculum development. Furthermore, competence is seen as an important factor of

competitive advantage. Not only does this hold for (the metaphor of) the core competence of the organisation, key competencies of individuals are also seen as their personal strengths with which they can function and excel and find a place in the labour market.

However, there are some remarks to be made. The relationship between education and the labour market is of dynamic nature. There are constant changes in the world of work, caused by crises in the economy, reorganisations of companies, the organisation of work, changes in technology and declining labour rights. But there are also permanent changes going on in education, such as broadening or focusing educational programmes, reprogramming and renaming study programmes, mergers and scale enlargement of educational institutions, internationalisation of study programmes, commodification of education, online learning, peer learning and authentic assessment. The world of work does not have a one-way influence on the world of education; the relationship is reciprocal. Education prepares young generations for society, who have their influence on what is being done in the world of work. Young graduates take their innovative ideas along into society and use and develop these further during the course of their early career. This concurs with the view of Vonken in his chapter where he speaks about the two sides of competent action as (1) coping with a given situation and (2) generating a situation itself. This view is consistent with the term Gestaltungskompetenz, or shaping competence, which enables people to shape their environment and the future, which is particularly applied in the context of education for sustainable development.

Furthermore, especially vocational and professional education institutions play a role in the innovation in regions by providing their expertise in the supervision of internships and applied research and development projects. These forms of regional collaboration of stakeholders, collective knowledge co-construction and hybrid learning configurations are getting more and more popular.

Apart from the dynamic relationship between education and work, education has to deal with a multiple set of stakeholders, amongst which are the students and their parents, the teachers, the state and various administrative institutions and nongovernmental organisations. Educational programming is a political process in which the interest of all stakeholders involved needs to be taken into account. This makes that the needs of the world of work should not dominate educational policy and practice; societal needs, scientific developments, students' interests, talents and personal needs and life skills in general should also be reflected in decisions around the content and practice of vocational and professional education.

Finally, alignment of the world of work and education should not be done in terms of preparing students for the labour market only, since the labour market itself is structurally changing. Receding employment rights, reorganisations and migration, but also creativity and market opportunities, make entrepreneurship becoming an interesting alternative or deliberate choice for employment. Gradually, older teachers, who have in fact avoided risk taking in their career by choosing for a relatively safe employment contract, are gradually getting convinced that there is an enterprise market next to the job market for which vocational and professional

education can prepare. Younger teachers who are suffering from the fact that they are getting temporary labour contracts for ever longer periods of time may not perceive education as a safe employment provider at all anymore. As a consequence of this, they may also find education for entrepreneurship more important although their premier interest may stay to get a permanent employment contract.

A key argument for maintaining a competence focus in vocational and professional education is that knowledge alone is not enough. Graduates must also be able to apply that knowledge in professional task or problem situations. So institutions for vocational and professional education should not only focus on knowledge delivery, they must include practicums, field attachments, internships and projects in their programmes by which the students learn to apply their knowledge in reality and assess their competence by authentic assessments as much as possible. In this way only can education protect itself against criticisms that it produces graduates who are licensed but not at all competent.

2. Key dimensions of conceptions of competence, theoretical backgrounds and origins

There are many differences in the definitions, theoretical backgrounds and origins of the competence-based education philosophy. The key dimensions by which conceptions of competence differ are the following:

1. *Centrality*: the degree to which a competency is part of the central competence base of a professional. This dimension refers to the position of competencies in all professional competence of an individual, which can range from central to peripheral. Central competencies are essential for effective performance and being used frequently, whereas peripheral competencies are less important.
2. *Contextuality*: the degree to which the meaning of competencies is generic or context specific. There are rivalling approaches to search for situation-specific or generic competencies to explain or predict performance (see the different approaches of Bartram and CanMeds as indicated in Chap. 1). There are no strict rules to determine whether competence needs to be generic or specific. The answer to this question lies in the context in which the competencies are being used. Human resource instruments tend to emphasise the generic nature of competence (see also Bartram and Roe 2008), educational programmes the specific nature of them. There is a high consensus though that competencies actually get meaning in a specific situation.
3. *Definability*: the degree to which desired competencies can be defined. There are critics who contend that it is impossible to define competencies, which resemble the critiques of opponents of the learning objectives movement in the 1970s; however, education has defined educational outcomes already for decades, and based assessment practices on these outcomes by which educational achievement was measured.
4. *Developability*: the degree to which a competency is developable or seen as a fixed trait. Trait psychology tries to explain human behaviour based on relatively fixed personal characteristics, whereas competence theory emphasises

the developmental nature of competence; obviously, competence development which is not based on talents of individuals will go at a high cost.

5. *Dynamic nature*: the degree to which competence is triggered by or expressed in certain circumstances. There are various factors which make that competence is actually being used in specific situations, which include for instance culture, trust, opportunity, affordances, expectations, power, perceptions, intentions and rewards.
6. *Knowledge inclusion*: the degree to which knowledge is considered to be important in professional competence. Implementations of competence-based education may have neglected the role of knowledge in competence, but it is obvious that a sound knowledge base is an essential ingredient of professional competence.
7. *Measurability*: the degree to which competencies can be measured. According to some it is utterly impossible to measure competence; others claim that competence can be validly and reliably be inferred by observing behaviour, by self-assessments or by performance tests.
8. *Mastery level*: the level to which competence is achieved. According to some critics, there is a tendency of focusing on minimal mastery levels by using competency standards, leading to the risk of minimalism in education. On the other hand, there is a difference between mediocre, sufficient, adequate, good, very good and excellent mastery of competencies.
9. *Performativity*: the degree to which competence is related to performance. Since many relate competence to effective or superior performance, there is a risk that education is exclusively oriented towards achieving higher levels of performance in only those domains which are observable and measurable.
10. *Transferability*: the degree to which competencies can be successfully applied in professional situations. Transferability is related to the generality of competencies; the more generic, the more transferable they are.

However, there seems to be a common understanding that competence can be seen as a set of capabilities (or capacities as indicated by Roe 2002) which are necessary conditions for effective performance, although there are variations on this understanding, such as proposed by Weinert (2001) (as mentioned in the Chapter of Seeber and Wittmann), who saw competencies as necessary prerequisites for successfully meeting complex demands and who added motivational, moral and volitional components to the construct of competence, which leads Seeber and Wittmann to the conclusion that personal traits, capabilities, knowledge and skills are included in the construct. Adding complexity to the definition of competence is in principle not wrong, although it is a restriction, as competence is also needed while meeting noncomplex demands. Adding a moral dimension is also correct, as it is consistent with the taxonomy of the affective domain (Krathwohl et al. 1973), within which the highest level is internalising values, and related to the attitudinal dimension of the definition of competence in Chap. 1 of this volume.

But adding motivational and volitional components to the definition seems to be inconsistent with the theory of White (1959), which states that competence is a

motivation-and-will-driver, but not the motivation and will itself. Children want to learn to walk and speak, but that wanting is not the competence of walking and speaking itself.

Furthermore, in the context of high-performance work systems, Appelbaum et al. (2000) also differentiate ability (cf. competence), motivation and opportunity (to participate), which by discretionary effort lead to firm performance (Paauwe and Boselie 2004).

> In mathematical terms Applebaum et al. (op cit) say P = A × M × O, whereby P (Performance) is a product of A (Ability), M (Motivation) and O (Opportunity).
>
> Translating this to this volume which is focused on competence as performance requirement, this formula can be extended to

$$P = C_{ksa} \times O_{rpt} \times M_{ieo}$$

whereby P (Performance) is a product of C (Competence, consisting of knowledge, skills and attitudes), O (Opportunity, including resources, positions, task assignments), and M (Motivation, including incentives, expectations, objectives).

However, there seems to be disagreement about the use of standards related to competence. Much of the criticism from the UK (as formulated in the chapters of Hyland and Day) seems to be concentrated on this. On the other hand, there are advocates on the use of standards in competence-based education, such as Fukahori (2014), who point at the increased international transparency and comparability of qualifications. In his chapter, Vonken even states that everyone can be considered to be competent, only to different degrees. So he sees competence as a continuum of mastery.

Although competence and performance standards may have played a dominant and questionable role in the UK debate on competence-based education, competence mastery in itself is not limited by standards; on the contrary, competence can be mastered at varying levels, including levels of excellence and brilliance.

Theoretical backgrounds and origins described in this volume are manifold. Theories of social constructivism and learner agency (Billett), action theory (Vonken), professional expertise (Evers and Van der Heijden), capabilities (Cairns and Malloch), epistemology (Bagnall and Hodge), mindfulness (Hyland), professional development (Day), critical economy (Avis), integration (Hager) and alignment (Mulder) show the wide variety in this respect. Various of these theories go back to early notions of industrial competency (Dewey 1916), motivation psychology (White 1959), interpersonal competence and competence acquisition (Argyris 1962, 1965a, b, 1968), the lack of potential assessment in promotion (Peter and Hull 1969), the lack of prognostic validity of intelligence testing (McClelland 1973), worthy (cost-effective) performance (Gilbert 1978), education quality improvement (Grant et al. 1979) and competence in various domains, such as language and communication (Chomsky 1965, 1968), mathematics (Gelman and Green 1989) and intercultural communication (Hampden-Turner and Trompenaars 2000). These

latter themes relate to part IV of this volume in which many authors have addressed developments in discipline-oriented and transversal competence domains.

Disciplinary backgrounds of competence theories treated in this volume are also many, such as sociology and learning psychology (Billett, Nokelainen, Harteis), philosophy and action theory (Vonken), occupational psychology and expertise (Evers et al.), educational theory (Cairns et al., Hager, Mulder, Wesselink et al., De Jong et al., Perrenet et al., Lassnigg), philosophy of science (Bagnall et al.), spirituality (Hyland), professional development studies (Day), economics (Avis), labour relations (Stokes), cultural sciences (Popov et al.), psychometrics (Van der Vleuten, Sluijsmans and Joosten-ten Brinke, Blömeke), behaviouristic psychology (Barrick) and management theory (Barabasch). This variety shows that competence theory is truly an interdisciplinary theory or, rather, a collection of various multidisciplinary theories.

3. Focus and coherence in policy debates on the competence-based education

As a first observation, it can be said that at the level of international vocational and higher education policy development, there are many joint efforts, but at the country level, there are many differences. At the decentral level, the focus and coherence of the debates seem to be lacking. At the international level, there are a number of common themes, such as the alignment of vocational and professional education with labour market needs, transparency of vocational and professional education, the development of qualifications frameworks, the improvement of quality and equality of education, teacher education and professional development, authentic competence assessment, the accreditation of prior learning, etc., but at the level of individual countries, there are major differences in the debates. It also seems that the competence-based education innovation initiative has been, and still is, spreading across the globe in various versions. This makes that different countries are experimenting with certain versions of competence-based education which are already succeeded by newer versions in other countries. It seems as if the initiative originated in North America and was taken up in the UK and that there are trails from there to other countries within Europe, Australia and New Zealand and the other parts of the world: Latin America, Asia and Africa. This makes the international debate about competence-based education extremely difficult, and hence there are many miscommunications, as different countries are working with different versions of competence-based education in different stages of implementation and evaluation. On top of that, different scholars within certain countries have different interpretations of the competence concept.

Furthermore, due to country-specific legislation and politics, international vocational and professional education policy agendas are quite often meeting considerable resistance at national levels. A good example of this is the reception of the European Qualifications Framework (EQF) in various EU member states. The older and larger states have significant problems with aligning their educational frameworks to the EQF. Examples of this are the UK, France and Germany as described in this volume. Even at a lower level, there are more differences. See, for instance, the German debate on ASCOT in the chapter of Dietzen and the three approaches to

competence-based education in Germany as indicated by Ștefănică, which are the holistic approach by Rauner et al. (2009), the company-based competence approach which includes the use of competence frameworks with mastery levels which are being used for employee assessment as described by Erpenbeck and von Rosenstiehl (2003) and Heyse et al. (2004), and the approach to model professional competence using item response theory as described by Nickolaus and Seeber (2013).

There is no easy way out of this situation. It would be naive to propose that all countries should embrace one model of competence-based vocational and professional education, as differences between national cultures, legislations, educational systems and available resources make that impossible. However, what is suggested here is that more efforts are being made to arrive at common understandings and long-term education development policies which contribute to the effectiveness and societal appreciation of vocational and professional education. Various chapters in this volume show that there is still a long way to go, but that a consistent system of competence-based education can help in achieving that.

4. Value added of competence-based education

This is probably the most difficult issue regarding the current state of competence-based education (CBE). Not only is there hardly any international evidence which shows that CBE has added value for increased alignment of education and the world of work and the transition of graduates into (self-)employment, it also is a very difficult thing to empirically prove.

Regarding increased alignment of education and work, there is a wide practice in competence-based vocational and professional education to work with competence-based qualifications frameworks. These frameworks describe occupations or jobs which are being used for curriculum development, test development, and textbook or learning materials development. Teachers and students use these in teaching and learning. Given the many competency frameworks developed and used, it may be concluded that the competence movement has had a positive effect. It is not a coincidence that for teacher education and for many other vocations and professions national competence frameworks have been established by law.

Given the key driver behind the competence movement, the alignment of education and work, the crucial question of course is whether CBE had resulted in better transition of graduates into (self-)employment. In more general terms, it is necessary to know whether CBE is more effective that non-CBE. As the literature review of Lassnigg and the chapter of Wesselink et al. in this volume have shown, there is some, but not a convincing volume of, evidence of a relationship between CBE and its desired effects. This finding obviously leads to the next question, which is, why there is so little empirical evidence of the success of CBE. Is there any evidence that it is not effective? No, this is not the case; there is just very little research on the relationship between CBE and desired effects of it. Or is it that empirical analysis of the effectiveness of CBE is too difficult or hardly possible? Asking this question is answering it. The empirical study of CBE requires longitudinal comparative

approaches, preferably controlling for moderating factors. However, how simple this thought, it is quite difficult in practice to realise it:

1. CBE is a system innovation which takes several years. Research funding hardly allows for projects to run longer than 4 years, whereas education programmes for nurses, engineers and accountants alone already take four or more years. So, a longitudinal research design that can start at the development stage, and continue during the implementation and evaluation stage, is practically impossible. It would not fit in a regular third money funded research programme nor in a PhD project.
2. If a country decides to 'go' CBE, it tends to do that for a whole education subsystem. That means that there is no comparison group available, which means that a comparative approach (how well is CBE doing compared to non-CBE?) is impossible. Theoretically it would be possible to compare the performance of an educational subsystem of one country with that of another country, but such an international experiment, which is used in development economics, is problematic in education, as the education systems differ significantly in structure, culture, legislation, quality and politics.
3. Furthermore, there are no baseline data regarding the dependent variables of CBE, which makes it actually impossible to study real effects of CBE.
4. Apart for all these complexities, it would be difficult to handle counterfactual validity threats. Longitudinal within-country studies on school-to-work transition have to deal with macroeconomic and international development factors, which are essentially very difficult to account for. For instance, the effect of the banking crisis and the following economic recession has had much more influence on employment opportunities of graduates than any educational innovation, let alone the introduction of CBE.

Since it is also clear that CBE practices differ across countries, it would be more realistic to conduct case study research in which the development, implementation and evaluation of CBE are studied in a context-specific way. An international, longitudinal multiple case study design would be complex and costly, but certainly be worthwhile and viable.

5. **The role of competence frameworks and standards**

This issue is addressed in Chap. 11 in this volume. It can be treated here shortly. As stated in the answer on question 4, competence frameworks play an important role in the redesign of vocational, professional and higher education programmes. That is why so much effort is made to develop these frameworks for education programmes, professions and jobs. In many countries specific organisations are responsible for the design and approval of new education programmes, for the revision of courses and for quality control. In some cases inter-institutional frameworks have been developed which can be used by other institutions (see, for instance, the chapter of Perrenet et al. for higher education and the chapters from Germany on competence modelling). Professional associations are typically responsible for the development of competence frameworks for their professional groups. Examples of

this can be found in this volume (see, for instance, the chapter of Ten Cate on the medical profession). Many large companies and public organisations have also developed, adapted or implemented competence frameworks for their employees. Large human resource consultancy firms have been very active in providing standard competency frameworks and dictionaries for their clients to support their recruitment, assessment and competence management and development practices. These frameworks and standards have provided transparency in the collective expectations regarding professional performance and competence which is required for that.

6. Models for competence assessment

This theme has been treated at length in various chapters in this volume. Van der Vleuten et al. have given a review of methods for competence assessment, and Blömeke has added to that by pointing at the possibilities of item response theory and generalisability theory, acknowledging that competence is a multidimensional construct. Many competence assessment practices are based on self-assessment of students and perceived competence growth assessment by teachers. However, independent assessments by professional experts based on work samples using mastery rubrics seem to be more trustworthy when it comes to high-stake licensure for key professional tasks with inherent levels of high risk. The German cases in Part IV of this volume (e.g. by Ștefănică et al., Spöttl et al., Wuttke et al.) show interesting examples of how to deal with competence assessment. Some authors rely on cognition-based computer-supported assessment of competence, while others stress the importance of context-based socio-constructive competence assessment. Whatever the assessment practice, it seems that from a practical perspective and trust in professional competence, authentic assessment of student performance on relevant work samples, conducted by certified domain-specific expert assessors, is essential.

7. Regional/national approaches of competence-based education and development

As can be derived from the country chapters in Part II in this volume, there are quite distinct approaches in CBE across the world. In the UK the National Vocational Qualifications approach has been dominant, followed by the skills development agenda. This is described well in the chapters of Stokes and Evans et al. France was early to implement a national strategy for competence assessment, but the development of competence-based education or, rather, the alignment of the national qualification system to the European Qualifications Framework (EQF) is still complicated and in process (see the chapter of Le Deist). Germany has followed the competence movement later and has problems with the EQF as well. During the recent years, Germany has invested a lot in the development of competence models and measurement systems. This has resulted in fierce national debates about the way in which to measure competence development. For the time being, this debate seems to be won by those who have argued for the context validity of competence assessments at the detriment of those who have insisted on high levels of reliability and sophistication

in data analysis. Smaller countries within the EU have implemented their own versions of CBE during the last two decades. Former candidate and present new EU member states have followed the EU guidelines for enhanced cooperation in vocational education quite precisely and have implemented their versions of CBE as well (see, for instance, the chapter of Tütlys et al. in this volume).

The developments in the USA have been well described by Barrick in this volume. It can be seen that the CBE movement actually started in North America. It was taken up in the UK and related to the development of national qualifications frameworks (with variations for England and Wales, Scotland and Northern Ireland as described in Chap. 11).

It was also taken up quickly by the Australian and New Zealand VET systems (see the chapter of Cairns et al.), which resulted in quite considerable resistance. Approaches of capability-oriented vocational and professional education and frameworks of graduate attributes seem to have been received better there.

Other countries have followed the developments, also based on student mobility and international education development cooperation. Students from South and East Asia doing masters and doctoral programmes in Educational Sciences in Australia, Europe and North America have taken competence-based education ideas along to their home institutions and countries. Once in leading positions (up to the levels of vice chancellor or minister of education), they may have mixed these ides with their policy development agendas. International institutions, international donor agencies, development organisations and several large NGOs have been active in the dissemination and implementation of CBE practices as well. Examples of this from Asia have been described by Fan, Panth and Viet and from Africa by Van Halsema. Development approaches of these institutions are typically based on models applied in the home countries of the institutions or the consultants, which can result in competition between these approaches in support-receiving countries.

8. **Research regarding competence-based vocational, professional and higher education**

Looking back at questions formulated at the beginning of the composition of this volume, it can be said that there is some overlap between this question and question 4 as far as impact, added value and effectiveness of CBE are concerned. As has been shown, there is little added value to report, although CBE has been and still is a massive international innovation.

Other research is reviewed by the various chapters in this volume. The description of this research follows the design of this volume.

In Part I the research has a conceptual and theoretical nature. The chapters proposed different views on competence, and the tendency is to conclude that the integrated view on competence reconciles the differences of opinion, although some say that reconciliation is out of the question.

In Part II the research is about national approaches, which show the many international differences mentioned above. Intranational practices however are not coherent in many cases as well, which resulted in different visions on what has

happened and should be done within the respective nations. Major issues which are reported are related to the implementation of qualification frameworks and standardisation, assessments, quality assurance, insufficient resources, curriculum revision and teacher education, professional development and institutional management.

In Part III the research is aimed at specific aspects of educational systems. This is partly also about the implementation of frameworks for competence-based education, but also about recognition and assessment, and teaching and learning. Models have been developed with the aim to support the aspects of competence-based education mentioned. These models are related to a number of unique features of competence-based vocational and professional education. The research aimed at quality and outcomes shows that competence-based vocational and professional education needs a dedicated quality management and competence assessment system.

In Part IV the research reviewed is about competence domains. There is a strong emphasis on competence modelling and measurement in given competence domains such as the technical (Ștefănică et al.), engineering (Spöttl et al.), teaching (Wuttke et al.) and medical professions (Ten Cate) and on emerging transversal domains such as sustainability competence (Pavlova), complex problem solving (Neubert et al.), intuition (Harteis), entrepreneurship (Toutain et al.), global competence (Popov et al.), social competence (Seeber et al.) and computational thinking (Yadav et al.). These chapters show the power of the competence construct in defining and describing new or changing domains of competence.

50.4 Common Misunderstandings About Competence-based Education

As said, there are many theories, definitions, perceptions and opinions about competence-based vocational and professional education, and there is also a lot of confusion about this. Westera (2001) even wrote an article on this confusion, although that did not add much to solving that. During the course of the last 15 years, various issues are discussed in sometimes heated debates about the blessing or the curse of competence-based education (Mulder et al. 2009). Many of these issues however can be deconstructed as perennial misunderstandings about competence-based education in theory. Practical applications of competence-based vocational and professional education of course vary, and in some cases practices are not consistent with the principles or the espoused theory, but compromised by austerity measures and measures of economy of scale. Advocates and opponents of competence-based education will agree at least on the view that the purpose of education is certainly not to develop incompetence.

1. *Is competence-based education related to vocational and professional education only?*

There is a tendency to look at CBE this way, but this is not exclusively the case. There are various examples of the use of competence domains, like social, mathematical or linguistic competence, in elementary and general secondary education, and of competence-based studies in academic education, like psychology, business administration and engineering. Furthermore, generic competence covers social competence, citizenship competence, lifelong learning competence, self-regulation competence, etc. So generic competence is much broader than just about preparing students for the labour market.

2. *Is motivation an element of competence?*

Whereas White (1959) saw competence as performance motivation, motivation itself is a prerequisite for performance, like competence, self-efficacy and the opportunity to perform. If competence is the capability to perform, motivation is the will to perform; self-efficacy is the trust in oneself to be able to perform (at least) adequately. As described earlier in this chapter, these two dimensions should be added to the opportunity to perform according to the widely accepted tripod of Appelbaum et al. (2000). The absence of opportunity holds for persons who are unemployed although they are competent, or who are employed but forbidden to perform certain tasks, which in certain cultures definitely occurs, often as a consequence of gender, social status, power or tribal issues.

3. *Is behaviour a component of competence?*

Competence is seen here as a necessary though not sufficient requirement for successful performance. The remark often is that competence cannot be directly observed, and inferences have to be made from performance. That is exactly the case and is concurred by Shavelson (2010), who sees competence assessment as the measurement of a sample of behaviours of a person on a sample of tasks and responses, on a sample of moments in time, as determined by multiple methods and as scored by a sample of assessors. As Vonken is saying in his chapter (based on Hager 2004), 'judging competence always involves inference'. So competence assessment is conducted via performance tests for which the mastery of the specified competence is necessarily conditional. Although there are developments to measure the possession of competencies with questionnaires, correct inference of competence therefore hinges upon valid and reliable performance assessments until now.

4. *Is intelligence needed for competent performance?*

Like multiple intelligences (Gardner 1983), there are several competence domains. Intelligence is certainly essential for competent performance. Smartness in various domains helps with learning certain knowledge, skills and attitudes faster, but that does not imply that people who are less smart cannot achieve competence in any field, unless they have certain impairments. The pace of learning however

varies to such extent that organisations tend to select on essential competencies, as the development of those competencies may be too costly. Here we are touching the work of Gilbert, who was speaking about the cost of worthy performance (Gilbert 1978).

5. *Do competence frameworks dictate the way in which learning is organised?*

Maybe this was the case in the 1970s, when the behaviouristic view on competence prevailed, and education was organised in such a way that many competencies were trained and checked independently. In more generic and holistic views of competence, this is not the case. There are principles to take into account at micro-design level when a competence-based educational approach is taken, although there are many detailed considerations which pertain to subject matter, pedagogical content knowledge, target group and contextual issues. Competence frameworks are predominantly linked to the 'what' of education and are related to qualifications, educational objectives, attainment targets and intended learning outcomes. As already noted, they have implications for further educational development and planning activities, but the implications are neither exhaustive nor exclusive.

6. *Does competence-based vocational and professional education stress skills only?*

That is not correct. Vocational and professional (as in fact all) education finally has three broad objectives. It should enhance the capacity to learn, start a career and act as a responsible and participative citizen. In various stages of education, the emphasis can be on the acquisition of subject matter knowledge, skills development, attitudinal growth and integrity. But in competence-based education, as in fact in all education, there should be careful and coherent attention to the three broad objectives mentioned.

7. *Does competence-based vocational and professional education lead to minimising educational achievement?*

This is a gross misconception. The first competence frameworks which faced the problem of over-detailing were setting minimum standards and therefore acted like focusing on realising minimum standards in education. Although current competence frameworks specify the content of what has to be achieved in education at a minimum level, they cannot be accused of achieving this minimum as a maximum level. This Procrustean view would imply that there would be no variation at all in the (ideal) achievement of students. This view is totally different from reality in which student achievement is dispersed, as is also reflected in grading practice. The minimum standards are exactly what they are: a minimum in required performance, a minimum that has to be guaranteed by the educational institution when they declare that a student has completed a study programme. Beyond that minimum, student achievement can be excellent or even brilliant, which is often awarded with honours, (summa) cum laudes or other distinctions.

8. *Is competence-based education an identifiable education innovation?*

In his article on competence in competence-based education and training (CBET), Lum (1999, 2011) formulated various concerns regarding this education innovation. Below these concerns are summarised (in italics), and reactions based on the state of play regarding competence-based vocational and professional education as presented in this volume are given:

- *Competence as goal is not the same a CBET methodology.* That is correct. Before 1999 there were hardly any theoretically grounded principles of CBV&PE. These were formulated as there was a great need for that since various countries formulated lifelong learning and competence development policies.
- *Can-do statements cannot precisely be formulated as intended learning outcomes.* However, education, including CBV&PE, is always outcome oriented. Curriculum profiles define those outcomes. Not being able to specify education or learning outcomes would be like not being able to build chairs and bridges. It is by definition because of the common understanding of the specifics that technology exists.
- *Liberal education would change people and vocational education would not*; however, vocational and professional education is much more than just learning a specific job; it also leads to the development of a personal professional identity. It is like educating teachers and professors in teacher education, graduate education programmes and continuing professional development. During that process the identities of teachers, researchers and professors are being shaped. Competence-based vocational and professional education changes the outlook on the world of adolescents and young adults as well as liberal education.
- *Instead of proceeding with the concept of competence, the alternative capability is suggested.* However, the critical comments on competence are as valid as for capability, and the reactions on that would be identical. The reason for this is that in essence there is no difference between competence and capability. These are words for the same thing, referring to what people can do, or the ability to perform.
- *Liberal education should be aimed at serving the interests of young people, vocational education of those of employers.* This is the historic view on vocational education in the USA, which can be understood by the narrowly defined job-oriented programmes for (in many cases) the oppressed, and may hold for parts of vocational and liberal education in the UK, but it is hard to maintain the position that competence-based vocational and professional education, which provides students access to employment, entrepreneurship, societal participation and lifelong learning and development, is only in the interest of employers. It is as important for social inclusion, livelihoods and identity formation of young people. Of course, education should be liberal, in that it liberates young people and unleashes potential. However, the extreme vision of liberal education in many countries has also resulted in delivering graduates who know a lot but can apply little, leaving them behind in the search for survival in society. Poignant examples of that can be found in various African education systems, but also in Western societies, where many ‘professional’ graduates were officially qualified,

but in practice actually not competent. See the many complaints there have been about the quality of teachers.

The intricate relationship between views on liberal education and the importance of competence is very well shown by the LEAP initiative of the Association of American Colleges and Universities (AACU 2015). LEAP stands for Liberal Education and America's Promise, which is an ongoing initiative. Related to that initiative, the AACU agreed upon the LEAP Challenge, which is a call for colleges and university to stimulate students to do 'signature work' which is about applying what they are learning in a project which is meaningful for the students and society (https://www.aacu.org/leap-challenge). It is the application nature of the projects, which is interesting here. It resembles the work of the education counter, the academic consultancy training and the academic master cluster in Wageningen University (one of the globally leading universities in the agricultural and environmental sciences) very much. Commissioners in society, from public or private organisations, can submit project ideas to the university which then links them to courses throughout the bachelor and master programme and to integrating projects of student groups in the master programme. In all cases students are expected to develop solutions for the given (mostly open) problems, which significantly contributes to authentic learning and the feeling of contribution to solving real problems, which makes the learning experiences much more relevant. The Leap Challenge tries to overcome the gap between the traditional practice of elitist liberal education for some and narrow training practices delivered to others. It uses seven principles, which are all in line with the competence-based vocational and professional education philosophy described in many chapters in this volume. These principles are (1) aim high – and make excellence inclusive; (2) give students a compass; (3) teach the arts of inquiry and innovation; (4) engage the big questions; (5) connect knowledge with choices and action; (6) foster civic, intercultural and ethical learning; and (7) assess students' ability to apply learning to complex problems (op cit, p. 8). By the descriptions of these principles, it gets even more clear that this view on liberal education is strongly reflecting core ideas behind competence-based education. The principles, for instance, stress the importance of using essential learning outcomes which should establish a framework for their education; connecting education work and life; using a student-centred view on studying and monitoring study progress, including problems of the real world for learning to prepare students for citizenship and work; integrating personal and social responsibility in all study components; and using assessment for continuous improvement (see for full details about these descriptions op cit, p. 8).

This analysis of misunderstandings in competence theory and practice may not be convincing for opponents of the competence-based education philosophy, but advocates and opponents of this philosophy alike will agree (as said earlier in this chapter) on the view that at least the purpose of education is *not* to develop *incompetence*.

50.5 Further Research for Competence-based Vocational and Professional Education

Future developments in competence-based vocational and professional education research are aimed at regular characteristics of competence-based education, but also at more fundamental theoretical and empirical questions. Developments which are currently taking place in competence research and which will most likely get more attention during the coming years are the following:

1. Regular updating of competence frameworks. As society and work will keep changing, the competence frameworks which are being developed during the last couple of years will need to be updated. Revisions will be needed on a 3-year basis in many cases. This at least was expected by various professional associations mentioned in this chapter. Revisions may not always be fundamental, but throughout the years, they can be.
2. Zainun et al. (2015) and Kasule et al. (2015) showed that there is too little attention for teachers in competence-based education. More emphasis needs to be given to conditions under which teachers' competencies can be developed. Professional development can be characterised as has been done by Day in this volume and made more productive by better national labour regulations for teachers and human resource management policies and practices in educational institutions such as promoted by Runhaar in her chapter in this volume. Other work of Runhaar that can be used in this respect showed the importance of the relationships between team learning and shared understanding amongst team members in educational innovation contexts (Runhaar et al. 2014). Since policy-making regarding implementation of competence-based education is a team effort, team learning in competence-based vocational and professional education is therefore a crucial topic of research.
3. A stronger link needs to be established between research regarding the competence-based curriculum on the one hand and teaching and learning on the other hand. As said, many of the principles of competence-based education refer to curriculum issues (the what of education), whereas a more limited set of principles is aimed at the micro-design at the level of teaching and learning activities. However, if competence frameworks are defined for the curricula, and authentic competence assessment is implemented to promote learning, competence-based teaching and learning should follow.
4. An essential competence domain which will need more attention is argumentation competence. Reviewed by Rapanta et al. (2013), and empirically investigated in studies conducted by Noroozi (2013a, b), this field needs more attention as independent judgement and justification of professionals for their decisions and actions become increasingly important.
5. Research on competence development in organisations needs to be better linked to research on competence-based vocational and professional education. For instance, the work of Baggen et al. in European companies on entrepreneurial

workplace learning and opportunity identification competence tried to establish a relationship between presage, process, product variables, learner, work environment and process factors which were studied to assess their influence on opportunity identification competence (Baggen et al. 2016). The study showed that employees of small- and medium-sized companies were able to participate in the early phases of innovation and that the role of owner-managers was essential in stimulating entrepreneurial behaviour. The research of Birru et al. (2016) tries to explain variance in export performance by the variation in international business competencies. Key variables in the study are international, export market and international entrepreneurial orientation competence. The study shows positive relationships between the three competence domains and export performance. The interactions between the international business competencies have mixed effects on financial export performance. Finally, the study of Osagie et al. (2014) on individual competencies in the field of corporate social responsibility (CSR) that support the implementation of CSR policies in organisations showed eight competencies which are relevant. These are (1) anticipating CSR challenges, (2) understanding CSR-relevant systems and subsystems, (3) understanding CSR-relevant standards, (4) CSR management competencies, (5) realising CSR-supportive interpersonal processes, (6) employing CSR-supportive personal characteristics and attitudes, (7) personal value-driven competencies and (8) reflecting on personal CSR views and experiences. The findings of these studies have direct consequences for innovation, entrepreneurship and CSR competence development in vocational and professional education.

To conclude this section, the overview of developments in research given above is obviously far from complete. There are many more developments, inside and outside educational research, which are to a greater or lesser extent relevant for competence-based vocational and professional education. A next volume would be needed to expand the scope of this volume to review the whole field of competence. For instance, a recent search in the Web of Knowledge on the keyword competence showed a wide variation of interesting studies of which most are highly relevant for competence-based vocational and professional education in the respected fields. The top ten of the most recent publications from this search will be described shortly here, just to taste the flavour of the diversity and relevance of the studies on which they report.

The majority of these publications are on professional competence. Liou et al. (2016) developed and tested an instrument with which perceptions of nurses of clinical reasoning competence can be assessed, and Desbouys et al. (2016) surveyed nurses' influenza vaccination competence in France. Sessler et al. (2016) showed differences in blood pressure management by anaesthesia residents as measured by competence committees and in-training exams. Curran et al. (2016) published a study on inherited competence and spin-off performance. Mason et al. (2016) studied the effects of placements of junior doctors in emergency departments on their perceived well-being, confidence and competence. In the field of medical research, Weller (2016) reported on a study on residents, which are medical graduates who

are working under supervision. Monitored electronic anaesthesia records provided objective performance data, based on which resident competence can be inferred. This can play an interesting role in their assessment and further professional development.

There are also interesting studies in other fields, for example, in child studies, Hands et al. (2016) reported research on the relationship between gender and motor competencies and perceived physical activity outcomes of children of 14 years of age. Zeedyk et al. (2016) studied perceived social competence and loneliness amongst young children with ASD.

Finally, there are studies which go into the competence of bacteria, which is a known field in biology research (as mentioned in Chap. 1). In the field of biology, Bach et al. (2016) published research on a specific competence of bacteria which promote plant growth. Lin et al. (2015) studied competence for genetic transformation and virulence in a certain bacteria.

Obviously, the studies on professional competence are most directly relevant for competence-based vocational and professional education. The studies on child studies seem to have a possible indirect relevance for this education sector, although they are directly important for special needs education. The studies on bacteria are least relevant, although at conceptual level, they are related to the debate on nature or nurture regarding competencies of children, students and professionals.

Research in cell biology and nanotechnology, including research on the functioning of the human brain, may however appear to be extremely relevant on competence acquisition in the future. The Internet and social media have opened up whole new grounds for time- and space-independent distributed learning. But science and technology develop ever faster, and bionic brains, virtual telepresence of experts, learning robots, drones and teleportation of energy are no fantasy anymore. They exist in reality. Vocational and professional education has to prepare itself for these radical innovations, as they may fundamentally change the way in which competence will be developed.

50.6 Further Observations and Comments

This section of this chapter presents a number of further observations and comments:

1. **Much more evaluation studies needed on the value added of competence-based vocational and professional education**

It is staggering to see how little research has been done on the measurement of effects of competence-based vocational and professional education. Above various reasons for this have been given for this. Lassnigg pointed at the unwillingness of policymakers to critically examine approaches which they have advocated. Also, given the fact that competence-based vocational and professional education is a generic educational philosophy with heterogeneous operationalisations, it is difficult

to craft a meaningful evaluation approach. The complexity and diversity of vocational and professional education also plays a role. Furthermore, as said, CBE is a systemic innovation, which lasts years before it is fully implemented. This means that longitudinal research designs are needed to enable measurement of change. Finally, research funding for vocational and professional education is hard to find. Nevertheless, there is a great need to show effects of CBE, and therefore it is strongly recommended to conduct studies which critically evaluate competence-based vocational and professional education practices.

2. **Competence and socio-constructivism**

Bagnall states that educational practices in which various epistemologies are combined risk incoherence, since the epistemologies make incompatible claims. That, however, remains to be seen. At micro-level, education is enormously complex, and elements of various epistemologies can exist *in action.* Bagnall also contends that from a disciplinary epistemological perspective, the ends of CBE neglect the knowledge dimensions of occupations. However, this is not necessarily true; it depends on how knowledge development is treated in the curriculum or practice. See, for instance, the work of Wenger (as cited in the chapter of Seeber and Wittmann) who states that '… knowing is an act of participation in complex 'social learning systems' (Wenger 2003, 76)' and who defines social competence as '… what it takes to act and be recognized as a competent member' of a community of practice (op cit, 78). In education it is possible to treat knowledge as a separate domain within a macro-framework of competence-based education. As said earlier, having a competence-based curriculum does not necessarily mean that disciplinary knowledge should not play a crucial role. Without sound knowledge there is no application possible. Furthermore, Bagnall points at the importance of a constructivist epistemology, which does not neglect growth, development, responsibility and awareness. This critique however is based on notions of CBE1.0, which were in place in the 1970s and 1980s, during the beginning years of pure instrumentalism. However, in the 2010s, these notions are obsolete, and CBE practice much more advanced. Current CBE practices are not anymore rooted in instrumental epistemologies, which Bagnall believes. The alternative for the development of vocational and professional education he suggests should be progressive and based on a constructivist epistemology. This is correct, although, as said, CBE practice has progressed significantly, and many current perspectives and practices of competence-based education are already based on socio-constructivist notions, in the sense that educational designers realised that learners construct their knowledge themselves, in cooperation or dialogue with others. This is the foundation of practically all attempts to implement activation-based pedagogies and collaborative learning. So, many CBV&PE practices are not as instrumental as suggested. Furthermore, implementing a competence-based education philosophy implies a competence development imperative. That means it is hard to maintain that current competence-based education approaches could neglect development. Gradual increasing responsibility is the precise intention of competence development; see the various levels of the European Qualifications Framework. Awareness goes along with personal growth in

a competence-based education environment. It is the continuous attention for learning, assessment, feedback and reflection that makes self-consciousness and self-efficacy grow.

The critique from an emancipatory epistemological perspective that CBE exerts control by powerful interests may be correct in some places, but when a competence framework is developed by all stakeholders involved and competence-based education is designed and implemented by teaching teams, it is not correct that one powerful force, like the industry, is pushing certain competencies into the curriculum. It is the balanced influence of all stakeholders involved, including the students or their representatives, which make the curriculum. Obviously objectives/outcomes are pre-stated in competence-based vocational and professional education, but is that not the case in all vocational education and training? After all, masons, cabinet workers, car mechanics, nurses, secretaries, controllers, engineers, architects and medical specialists need to be able to perform in work situations according to the expectations which exist, expectations not only of the employer but also of the professions, institutions and the public.

So the view of Bagnall that there will be a paradigm shift in education which will be informed by one of the alternative epistemologies may be realised already, in that, as said, vocational and professional education practices are already based on various epistemologies, at different levels, by different stakeholders. Personal professional epistemologies of teachers vary; educational innovations are interpreted by them, and educational practice is based on their personal goal structures. The same holds for competence management. According to Quinn et al. (1996), management should be based on different – even conflicting – values, roles and competencies. This diversity makes better teams. But also in competence-based vocational and professional education, many of the alternative epistemologies are simultaneously in use. This is visible in concurrent practices of cooperative knowledge construction, cognitivistic instruction and professional activism of teachers which is based on emancipatory epistemologies. Current competence-based education philosophy tries to point at the societal relevance of the curriculum, the need for whole-person development, stimulating engagement in continuous lifelong learning activities, focusing on future-oriented competencies (problem solving, creativity, innovation, transformation, shaping) which are needed in a volatile, uncertain, complex world. Preparation for work (which can be self-employment or entrepreneurship) is but one, although important, dimension of that, apart from social participation and learning to learn.

In response to a final issue raised by Bagnall, regarding the, in his words, futile attempts to develop hybrid versions of competence-based vocational and professional education, it can be said that boundary crossing in and hybridisation of vocational and professional education are just key trends, which involve competence development, practical intelligence, critical consciousness, self-directed learning, entrepreneurship, risk taking and learning to cope with wicked problems (Cremers et al.). Several stakeholders are joining forces in hybrid learning configurations, such as educational institutions, governmental organisations, NGOs, businesses and researchers. CBE is in fact already a hybrid practice in which many different

approaches are integrated. The idea of integration of visions and approaches was also the foundation of the matrix of CBE, a method to empower teaching team to develop their own version of competence-based vocational and professional education (see the chapter of Wesselink et al. in this volume).

3. **Not all competence is expressed in performance**

Competence in itself cannot be observed from outside. It can only be observed via performance. For example, a great talent for playing piano will never be turned into competent or excellent piano playing if a person does not actually practice piano playing. It is by the playing, which is the actual performance, that competence can be inferred.

However, not all competence is expressed in performance. Vonken, in his chapter in this volume, uses the crude example of drinking beer and mentions that the capability of drinking a number of beers does not imply that people actually drink that number of beers. The example can be made more crude even: the competence of killing people does not mean all people do this all the time. Other competencies, in the affective domain, prevent persons from not performing hazardous or illegal activities. Apart from these crude examples, there are also more subtle variations of competence which are not being materialised in action. For instance, in certain cultures social competence prevents people from giving their personal opinion about certain events, as this goes against the code of conduct or protocol, although they could, if they were allowed to.

4. **Competence as graduate attribute**

In this volume graduate attributes are seen as an alternative for competencies of graduates (see, for instance, the chapter of Cairns and Malloch). If competence is gained by experience and exercise and expressed in performance, this competence in itself can be attributed to a person and is indeed a graduate attribute. Speaking of competencies as graduate attributes is therefore completely legitimate; however, if graduate attributes are seen as generic characteristics of graduates, graduate attributes are a set of characteristics of persons which is wider than competence or a range of competencies. So, all competencies are graduate attributes, but not all graduate attributes are competencies.

5. **Creativity is part of competence**

In this volume, competence is defined as a prerequisite for effective performance, thus for behaviour. Competence should enable reproducible performance, but competence is more than the capability to reproduce behaviour. As Vonken in his chapter pointed out, Noam Chomsky (1965) understood speech as performance and the ability to speak as competence. Vonken stressed that speaking was seen as a creative and generative process, as Wilhelm von Humboldt (1836) said earlier. With certain competencies persons can indeed be creative. It is the very nature of art, science, design and innovation, by which persons arrive at new observations, interpretations and explanations and create new views, approaches and solutions.

6. **Competence and self-responsibility**

As White (1959) has stated, competence is a motivation factor; it is the will to master and starts as an innate driver of development. However, not all persons pursue the highest level of mastery. Along the development process, some give up, and others go on and want to further develop, get better or be even excellent. This is the choice of people, although facilitated or constrained by personal circumstances, school and work history and life events. Nevertheless, people themselves stay responsible for their own competence development.

7. **The attribution of competent behaviour in dependency relationships**

In many current work processes, coworkers are depending on one another for information, inputs, resources, tools, feedback, etc. As an example, this is very clear in teaching physics. For certain physics theories, it is necessary to have sufficient mathematical knowledge and skills. If the teaching in mathematics lags behind, teaching and learning in physics may be hampered. Can suboptimal learning results of classes who take physics then be attributed to the quality of the physics teacher? The answer is obvious. It is the performance in mathematics teaching which causes problems in physics teaching. Many other examples can be given of course, such as in language teaching, where the learning of foreign languages hinges upon the teaching of grammar in the mother language, or in work processes of high-performance teams, where performance is very much related to resources provided by management. The understanding of this has resulted in much more attention for team work and the notion of collective competence.

8. **Competence**, **savoir, savoir-faire, savoir-être**

The concepts of savoir, savoir-faire and savoir-être in France seem to be equivalent to the definition of competence in Chap. 1: competence as integrated knowledge, skills and attitudes (knowing, knowing how to do and knowing how to behave). However, the issue is that in the French language all three components of competence are phrased as savoir, so knowing or knowledge. But, as said, a fundamental characteristic of competence is that it goes beyond knowing and knowledge, since knowledge alone is not enough for productive or effective performance. Competence implies the ability to perform to certain standards in given situations which can vary in complexity and novelty. It implies that existing knowledge can be transferred to other, sometimes new, problem situations.

9. **Competence and labour relations**

There has been considerable resistance against the implementation of competence management and development practices because of the protection of employment rights by employee organisations. Employment rights are based on national personnel laws, labour agreements and organisational regulations. Typically,

employees are being protected by the labour contract they have with their employer, including job titles and job descriptions. These job titles and descriptions are often part of job buildings, which are related to payment schemes and annual results and development meetings. Many organisations have found these job buildings conservative in that they prevented flexibility in task divisions and thereby inhibited innovation, as tasks divisions were used as an excuse for not having to change. The implementation of competence management practices was quite often hampered by the influence of labour unions which were advocating job structures and task descriptions as established rights.

10. Competence 1.0, 2.0 and 3.0

As a follow-up on the division of the development of competence theory in three stages (see Chap. 1), competence itself, and the underlying competencies, can be divided in three categories, which are labelled here as competence 1.0, competence 2.0 and competence 3.0. These competence domains and underlying competencies are related to the three groups of competence theories:

Competence 1.0 refers to behaviouristic skills (see the chapter of Barrick) and, used in systems of mastery education, tends to consist of detailed lists of tasks and skills. Examples of this can be found in competency profiles for teacher education in the 1970s in the USA. For instance, teachers were taught to stand in the corner of the classroom to have an overview of what all pupils were doing or to walk up and down in front of the classroom to retain attention of the pupils. Performing all these small skills and checking the mastery of them did not make good teachers though who were basing their teaching philosophy and practice on scientific insights and empirical evidence. It also did not result in inquiry-based teaching practice and reflection in action (Schön 1983). Competence 1.0 can be characterised as an attempt to map competencies which are relevant for detailed task performance or closed activities.

Competence 2.0 is a reaction to the behaviouristic mastery education philosophy and practice and evolved in the 1980s when competence was more seen as an integrated set of capabilities acquired by professionals which enabled them to effectively carry out tasks, solve problems, shape innovations, etc. These integrated competencies are by some seen in terms of responsibility levels (such as in the European Qualifications Framework), but also as the common domains of professional knowledge (Eraut 1994) or professional expertise (Ericsson 2009). Sometimes termed holistic competence, competence 2.0 is related to core tasks and work process knowledge (Boreham et al. 2002; Scheib 2004). Competencies like (further specifications of) the great eight, leading and deciding, supporting and co-operating, interacting and presenting, etc. (Bartram 2005), are connected to work process charts and make units of education. Although clear in design, this application of competence mapping against work processes has again resulted in extensive and detailed documents which were hard to implement in vocational and professional education, questioned by employers' associations

and problematic in test development. However, good practices exist, such as described in the chapter of Wesselink et al. Competence 2.0 can be characterised as an attempt to formulate integrated competency statements which are relevant for larger responsibilities within known occupations and professions.

Competence 3.0 is a reaction to both competence 1.0 and competence 2.0 statements for closed tasks and known occupations and professions, in the awareness that although the future is unknown, current problems need to be addressed to create a sustainable future. Competence 3.0 is thus aimed at identifying capabilities or capacities which are relevant for an unknown future and close to what has been defined as shaping competence in the context of education for sustainable development. These competencies are being able to develop knowledge which integrates global openness and new perspectives; analyse and assess future-oriented developments; develop interdisciplinary knowledge and act in an interdisciplinary way; recognise and assess risks, dangers and uncertainties; plan and act cooperatively; handle goal conflicts during reflections about acting strategies; participate in collective decision-making processes; motivate self and others to get in action; reflect own views and those of others; use notions of justice as foundation for decisions and actions; plan and act independently; and show empathy for others (see for an extension of this http://www.transfer-21.de/index.php?p=222 and Wals 2015). Based on an overview of the field of human competence and various chapters in this volume, the following set of future-oriented competencies can be formulated: ambiguity handling, argumentative reasoning, balancing interests, complex problem solving, computational thinking, creativity – creation, entrepreneurship, global competence, intuition, mindfulness, negotiating meaning, professional identity, resilience, sustainability, transformation and uncertainty handling. Current vocational and professional education institutes should include these in their programmes to prepare the next generations of professionals for the future world, which will not be less vulnerable, uncertain, complex and ambiguous. Competence 3.0 addresses competencies which are meaningful in professional situations in which standard solutions for known problems do not apply, but in which creative solutions are needed to solve unknown problems and transformation is shaped of current practices towards a more optimal state for those who are involved, be it clients, commissioners, citizens, coworkers, children or students.

11. **Does competence-based education have a pronation to closed professional domains?**

It seems that Lassnigg in his chapter tries to explain the ease by which a competence-based education approach can be implemented by the nature of the professional domain. For example, some professions, like in health care, the nuclear industry or the aviation industry, are quite closed (or 'well established' 'with a relatively clear structure and marked borders' as he described it), in the sense that doctors, operators and pilots are bound by fixed protocols for their performance, whereas other professions or professional fields are more open, like in the creative industries, innovation and transformation, in the sense that there are no standard

operating procedures. However, these professionals require different competencies. Occupations and professions with more closed performance procedures may need more competence 1.0 and competence 2.0 ingredients, whereas those which are more open, and which predominantly rely on heuristics, may need more from the competence 3.0 domain. This would mean that the competence-based education philosophy equally applies to the different occupations and professions, but that it should not be a one-size-fits-all practice.

12. **Knowledge alone is not enough; skills neither**

In their chapter, Spöttl and Musekamp go into the modelling and measurement of mechanical engineering competence. They limit this to the cognitive aspects of the field of science. They argue that this is defendable as domain-specific knowledge is important to teach in higher engineering education, which obviously is correct. They furthermore state that current higher education teaching practice in Germany is textbook based and that these books follow the structure of disciplines.

Although it is utterly important to acquire sufficient subject matter knowledge in vocational and professional education, there is the risk of treating the cognitive domain separately; it is at least not in line with the integrated view on competence as presented in Chap. 1 and in other chapters in this volume. Reality presents itself as a *Gestalt* and is complex, opaque and interdisciplinary in nature. Teaching and learning should address this and keep in mind that professional performance is taking place in this holistic reality. In that reality professionals need knowledge, skills and attitudes which enable them to effectively carry out all kinds of activities, solve problems and invent new solutions and contribute to change, innovation and transformation, in known and expected task situations and in unknown and unexpected ones.

Education should prepare students for that, and if the introduction into science means that students have to learn domain-specific content from structured textbooks alone, they may be induced into science in a way which is too narrow and concentrated. It may result into professionals who are nearsighted and who do not have a sufficiently broad view on their field, adjacent disciplines and occupations, and those which are totally out of their domain. It would hamper interdisciplinary work and cooperation, which is much needed in coping with current challenges. It may be assumed that Spöttl and Musekamp would not want this, and that they themselves have a broader view on all competence-based higher engineering education, but this is to make a precautionary remark: selective attention to the cognitive domain can hamper the broader intentions of the competence-based education approach.

The chapter of Nägele and Stalder can be discussed in a similar way, as they exclusively treat the skills domain of competence. Like knowledge, skills are a conditio sine qua non for effective performance. However, focusing on the skills domain alone can lead to the under estimation of the importance of knowledge included in skills application. In the1980s the saying was popular that it is possible to teach monkeys tricks, but harder to teach them insight. The theoretical background of this metaphor was that in fields like office automatisation and production technology,

students should not only learn skills but also the conceptual principles behind those skills, first of all to warrant that they understand what they are doing and secondly to make them more agile in accommodating change. The assumption was that competence based on the understanding of the theoretical or systematic principles behind practices would be more transferable to other task situations than the skills base itself. In his chapter Billett points at the phenomenon of mimicry, the practice by which behaviour of others is copied. This copying takes place, but it does not guarantee that copied behaviour is based on professional argumentation and justification. Since liability is becoming an ever more serious element of many occupations and professions, education should definitely include the knowledge background of skills.

The integrated view on competence has also implications for the assessment of student achievement. This has been treated already in the chapters of Van der Vleuten et al. and of Blömeke. In competence-based education, the tendency is to work with systems of holistic assessment. Although this is good practice, there should be sufficient attention to the measurement of the acquired knowledge. Competence-based education, which pays balanced attention to integrated knowledge, skills and attitudes, should have assessment strategies and instruments in place by which the required knowledge, skills and attitudes are validly tested, preferably in continuous formative and authentic assessment, which is in fact assessment for learning, but also in valid summative assessment. Separate tests of knowledge, demonstrations of skills and showing professional attitudes can be necessary, as long as the integrated competence of graduates is the end result.

50.7 Final Conclusions

In the first chapter of this volume, the purpose of this volume was stated. The intentions were to clarify the manifold meanings and approaches of competence-based vocational and professional education, to show the diversity which exists not only in theory but also in practice, to explain backgrounds of this diversity, to get more transparency of views, to bridge opposing positions, to inform about debates, to at the end contribute to the improvement of competence-based vocational and professional education policies and practices and the further development of competence theory and to give a perspective for further research.

It is of course up to the judgement of the reader whether these intentions are realised, but the following can be said about this. In Part I different meanings of competence from the perspective of social learning theory, educational philosophy, professional expertise research, graduate attributes theory, social constructivism, cognitivism, epistemology, Eastern philosophy, professional identity theory, critical socioeconomic theory and educational alignment theory were presented and discussed. This was complemented with an integrated view on competence which states that various paradigms can be reconciled to one, although other authors are opposing that view. Some are even contesting the value of the theoretical notions

outlined in Chap. 1 of this volume. A strong argument for the position that reconciliation is possible, and hence a synthesis is feasible, is that in daily practice in education, all sorts of conflicting inter- and even intrapersonal working theories about good vocational and professional education exist. For example, there are differences about the extent to which this type of education should be theoretical or practical, liberal or functional, cooperative or competitive, reflecting different world views, political preferences and education ideals such as the social or liberal state, collectivism or individualism, inclusion or exclusivity and all kinds of mixes between them. In practice, good education works well if teams conduct healthy and constructive dialogues about their collective intentions. In that daily dialogue or deliberation, all views and preferences come together in collective action for the best education teacher teams can provide.

In the various parts of this volume, the different backgrounds are explained by different authors. These explanations may help to appreciate the differences in opinions regarding the introduction and implementation of competence-based vocational and professional education. It may be clear that the context in which competence-based vocational and professional education is being implemented matters a great deal. In the UK the debate about the value of competencies in education is heavily dominated by the critiques on the way in which the National Vocational Qualifications were introduced. In France the debate on competence is mostly about competence management in organisations and competence assessments of individuals and the difficulty to establish the reference with the European Qualifications Framework (EQF), as in France the existing qualification structure does not exactly match with the structure of the EQF. Actually, in Germany the same situation exists, as in German competence-based vocational and professional education competence is seen as the overarching capability of people to perform, whereas the EQF juxtaposes knowledge, skills and competences. German competence-based vocational and professional education experts themselves however fundamentally differ in opinion about the cognitivist and socio-constructivist view on competence-based vocational and professional education, which is sharply visible in the debate about the way in which professional competence should be assessed: by cognitive tests or by integrated assessments which are based on work process knowledge. Examples from other countries such as the USA, the Baltic States, Italy, the Netherlands and other countries from Asia and Africa show varieties of the approaches which are extensively described by the authors of the chapters. So it is hoped that this volume indeed contributed to a higher level of transparency of views by making the differences visible.

This chapter listed the features which make competence-based education a unique innovation. It pointed at the recently developed key competencies in the EU, the EU guidelines for assessment, and the 2015 Riga Conclusions on key competencies. It furthermore gave examples of recent EU ICT and Logistics competence frameworks. The chapter also referred to competence initiatives of the OECD, UNDP, ILO and UNEVOC. These examples show that competence-based education is a truly world-wide innovation.

The chapter answered the eight questions raised in Chap. 1. such as on key drivers behind and dimensions of competence in practice and theory. The chapter proceeded with the discussion of common misunderstandings about competence-based education, and articulated questions for further research. Next, final observations were made and comments were given. As said, more attention needs to be given to competence for the unknown future. In this chapter this was called competence 3.0.

The main conclusion of this volume is that much has been achieved by the competence movement in vocational and professional education, but that there remains a lot to be done to realise its full potential and show its added value. Critical analyses have to be taken into account as much as possible, to overcome the challenges this education innovation faces. The reflections and discussions presented in this volume can be used for that.

In sum, although diverse, the collective intention of the competence movement is to align vocational and professional education with the developments and needs in the world of work, science and society, and thereby, to raise the quality of labour-market oriented vocational and higher education, in the best interest of all stakeholders involved.

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ERRATUM

Competence-based Vocational and Professional Education

Bridging the Worlds of Work and Education

Martin Mulder

M. Mulder (ed.), *Competence-based Vocational and Professional Education*, Technical and Vocational Education and Training: Issues, Concerns and Prospects 23, DOI 10.1007/978-3-319-41713-4

DOI 10.1007/978-3-319-41713-4_51

Erratum to:

Chapter 37 in: Michael Sailer, Jan Hense, Heinz Mandl, and Markus Klevers, Fostering Development of Work Competencies and Motivation via Gamification, DOI 10.1007/978-3-319-41713-4_37.

The original version of this chapter was inadvertently published with incorrect F values in the results of MANCOVA listed in page 811 and 812. The comma in the brackets was erased which resulted "F(1100)" instead of "F(1,100)"

The updated original online version for this chapter can be found at DOI 10.1007/978-3-319-41713-4_37 and DOI 10.1007/978-3-319-41713-4_48

M. Mulder (ed.), *Competence-based Vocational and Professional Education*, Technical and Vocational Education and Training: Issues, Concerns and Prospects 23, DOI 10.1007/978-3-319-41713-4_51

The value of 21.98 was published incorrectly as 21,98 in the original version of the book. It is updated in page 811.

- Regarding *quantitative performance*, the gamification group achieved 62.44 (*SD* = 15.92) picks on average, while the control group achieved 46.82 (*SD* = 18.92) picks. A MANCOVA indicates that this quantitative performance is significantly higher in the gamification group than in the control group, $F(1,100) = 72.49$, $p < .01$, $\eta_p^2 = .420$.
- Regarding *qualitative performance*, the gamification group achieved an accuracy rate of 94 % (*SD* = .07) on average. The control group achieved an accuracy rate of 87 % (*SD* = .14) on average. A MANCOVA indicates that this qualitative performance is significantly higher in the gamification group than in the control group, $F(1,100) = 21.98$, $p < .01$, $\eta_p^2 = .180$.

2. *To what extent can gamification work-integrated training environments foster experiences of competence, autonomy regarding task meaningfulness, autonomy regarding decision freedom and relatedness?*

- Regarding the *experience of competence*, the gamification group scored 4.81 (*SD* = 1.40) on a seven-point Likert scale, while the control group scored 4.11 (*SD* = 1.13). A MANCOVA indicates that participants from the gamification group have significantly higher experiences of competence than participants from the control group, $F(1,100) = 8.11$, $p < .01$, $\eta_p^2 = .075$.
- Regarding the *experience of task meaningfulness (autonomy)*, the gamification group scored 5.46 (SD = 1.06) on a seven-point Likert scale, while the control group scored 4.34 (*SD* = 1.38). A MANCOVA indicates that participants from the gamification group have significantly higher experiences of task meaningfulness than participants from the control group, $F(1,100) = 18.90$, $p < .01$, $\eta_p^2 = .159$.
- Regarding the *experience of decision freedom (autonomy)*, the gamification group scored 4.03 (SD = 1.49) on a seven-point Likert scale, while the control group scored 3.64 (*SD* = 1.58). A MANCOVA indicates that participants from the gamification group have significantly higher experiences of decision freedom than participants from the control group, $F(1,100) = 4.03$, $p < .05$, $\eta_p^2 = .039$.
- Regarding the *experience of relatedness*, the gamification group scored 3.31 (*SD* = 1.47) on a seven-point Likert scale, while the control group scored 1.93 (*SD* = .99). A MANCOVA indicates that participants from the gamification group have significantly higher experiences of relatedness than participants from the control group $F(1,100) = 27.85$, $p < .01$, $\eta_p^2 = .218$.

Erratum to:

Chapter 48 in: Susan Seeber and Eveline Wittmann, Social Competence Research: A Review, DOI 10.1007/978-3-319-41713-4_48.

The original version of this chapter was inadvertently published without reference for figure 1. The reference is updated in the reference list as : “Kanning, U. (2009b). *Inventar sozialer Kompetenzen*. Göttingen: Hogrefe”.

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