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NON-COGNITIVE FACETS OF COMPETENCE

Theoretical Foundations and Implications for Measurement

INTRODUCTION

There is a growing interest in the definition and assessment of competence. Particularly in the context of vocational education and training it is vital to have reliable and valid information about individual competences. Despite its long tradition, student testing has increasingly been criticized in the United States, while there are several reasons for the current interest in this topic in Europe. Firstly, competence measurement gained recognition through the use of large-scale international assessments such as PISA, TIMSS etc. Secondly, in order to evaluate and compare the performance of educational units (schools, school types, districts, states etc.) and the effects of educational policy, testing students for their competence has become the criterion of choice. Thirdly, assessing competence might serve as a means of recognizing informal learning, for example, within the remit of the European Qualification Framework (EQF).

Though there is no broadly accepted definition of competence, the most common definitions build on Chomsky's distinction between competence and performance (Chomsky, 1965). Hence, competence is defined as a latent construct that is only observable in performance within the respective real-life domain. Thus, defining competences usually begins with the identification of typical demands in real-life situations. In turn, typical bundles of such situations are usually referred to as domains and are generally defined by practitioners of the respective practical context (Achtenhagen, 2007; Klieme et al., 2003; Lehmann & Seeber, 2007; Sloane, 2008; Winther, 2010). As a consequence, a common definition of competence derives from the DeSeCo initiative (Definition and Selection of Competencies) and refers to the widespread functional approach: "A competence is defined as the ability to successfully meet complex demands in a particular context through the mobilisation of psychosocial prerequisites" (Rychen & Salganik, 2003, p. 43). Furthermore, according to Weinert (2001), besides intellectual abilities, content-specific knowledge, cognitive skills, domain-specific strategies, routines and subroutines, competences are also comprised of "… motivational tendencies, volitional control systems, personal value orientations, and social behaviours" (Weinert, 2001, p. 51). Following Spencer, McClelland and Spencer (1994, p. 6) "any individual characteristic that can be reliably measured, counted and that can be shown to differentiate superior from average

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performers" is part of competence.[1] Within such broad definitions, competences cannot be clearly separated from personality traits, but there are smooth transitions (Corsten, 2001). Consequently, Erpenbeck and von Rosenstiel (2003) define competences as dispositions allowing for self-organized thinking and acting, while dispositions are defined as the individual prerequisites of action regulation. Attributing the particular extent of competence in an individual points to the prognosis (explained variance) of that person's future performance in complex domain-specific real-life situations, i.e. problem solving. Thus, whatever individual prerequisites contribute to this prognosis of future action, regulation should be considered as a possible part of competence. Whereas manifest performance might cursorily take the form of an unidimensional – in some cases even dichotomous – variable, the underlying competence, however, is multifaceted with regard to its subsurface structure. We subscribe to the view that competence is not an unidimensional construct but comprises multiple facets of individual dispositions (see also Breuer, 2006). However, most empirical studies merely focus on cognitive facets of competence, while non-cognitive facets, such as motivation and emotion, for several reasons, are widely neglected. In the present paper, we will emphasize the significance of non-cognitive facets of competence based on action regulation theories and discuss resulting implications for the investigation of competence. To date there are various approaches in dealing with emotional and motivational facets in modeling and measuring competences, which will be briefly outlined. An integrated approach will be considered for its implications for test designs.

NON-COGNITIVE FACETS ON VARIOUS ONTOGENETIC LEVELS

Without question, cognitive facets such as knowledge and general intellectual abilities are needed for competent action (Rychen & Salganik, 2003, p. 45). However, common psychological theories of action regulation also stress non-cognitive processes in perceiving and judging situations, elaborating action opportunities, decision making, and monitoring of action regulation. In general, "humans are built to respond to the things that matter, and the way humans do it is by emotion" (Ellsworth, 1994, p. 150). Hence, knowing is a necessary, but not sufficient, prerequisite of competent action. Furthermore, the acquisition of knowledge of any kind is also reliant on non-cognitive processes (Dörner & Kaminski, 1988; Kuhl, 2001; Rausch et al., 2010; Rausch, 2011; Ruiz-Primo, 2009; Sembill, 1992, 1995, 2010; Schumacher, 2002; von Cranach & Bangerter, 2000; Wuttke, 1999).

Further support for the significance of affective evaluations in action regulation, as well as a deeper insight into the functioning of unconscious and conscious processing, are derived from neuroscience (Baer, Connors & Paradiso, 2009; Birbaumer & Schmidt, 2010; Damasio, 1995; LeDoux, 1994; Panksepp, 1998; Sembill, 2010): An evolutionary view of the functions of non-cognitive facets in action regulation underlines the power of neurophysiological principles in learning, reflecting and acting. It enables a better understanding of the sustainable growth of human beings

as well as similarities and differences to animals. When studying human behavior, it is necessary to differentiate between various ontogenetic levels such as *organ level* (e.g. brain, stomach, heart, kidney etc.), *individual level* (e.g. resources, dispositions, competences, world views etc.) and *social/group level* (e.g. acceptance, performance, responsibility etc.). However, findings obtained from different levels must not be mixed up: For example, one can neither draw precise conclusions on an individual's competence on the individual level nor predict the respective performance on the social/group level, only by observing neurophysiological processes inside the brain. Performance is based on knowledge, dispositions and competences, which, in turn, are based on acquired, stored and remembered information.

But where does the respective information come from? It is evaluated data (e.g. light, acoustic and compression waves), which are decoded and replaced by nervous and endocrine activity. The evaluation is directed to basic survival instincts and associated instincts to maintain one's orientation and behavioral safety. On an organ level these evaluations are implemented by the so-called limbic and endocrine systems, whereas the processes remain unconscious. In the following, we refer to these evaluations in terms of *affect*. If these processes become conscious on an individual level, the respective outcomes are referred to as *emotions* and *motivation*, which can now be reflected on as well as communicated on a social level. The social level, again, contains all elements and sub-processes of its emergence on lower ontogenetic levels. Similarly, knowledge, dispositions, and competences on the individual level contain all the elements and sub processes derived from their emergence on lower ontogenetic levels. One should be aware of the significance of processes on all levels for human action.

In the following, we focus on the interplay of cognition and affect within action regulation on the individual, psychological level. In doing so, we adopt an analytical perspective, while recognizing that cognition and affect are basically inseparable. We define affects as unconscious evaluative reactions to internal and external stimuli (implemented by the limbic and endocrine systems; see above). This perspective is in line with common appraisal theories, which propose an ongoing scanning of the environment with regard to the relevance for one's own needs, beliefs, values, norms, standards etc. (Lazarus, Kanner & Folkman, 1980 et passim; Scherer, 1981 et passim; Smith & Kirby, 2000 et passim). According to the appraisal theory proposed by Scherer and colleagues, continual unconscious stimulus evaluation checks (SEC) are considered to check every internal and external stimulus with regard to the following criteria: (1) novelty (unexpectedness), (2) intrinsic pleasantness (derived positive or negative evaluations), (3) goal/need significance (related to basic needs, motives, intentions, and goals), (4) coping potential (confidence in one's own ability to handle the situation), and (5) standards (moral evaluation of main and side effects) (Leventhal & Scherer, 1987; Scherer, 1981, 1999).

Whenever these affects exceed a critical threshold the respective contents under evaluation become conscious and distinct emotions may arise (bottom-up). Conscious processing, in turn, influences unconscious associative processing, i.e.

affective evaluations. Hence, whatever cognitive content is part of working memory in a particular moment determines for the future which subsequent stimuli are more likely to attract attention by priming (van Reekum & Scherer, 1997, p. 279; see also Aebli's notion of *intake*, Aebli, 1980). As working memory, i.e. conscious processing, is rather slow, requires a lot of energy and is limited in capacity, unconscious processing in terms of routines and patterns are preferred whenever available (Birbaumer & Schmidt, 2010; Gadenne, 1996). In turn, affective evaluations are required "... for the sake of signalling states of the world that have to be responded to" (Frijda, 1988, p. 354; see also *affect as information*-approach: Clore, 1994; Schwarz, 1990; Storbeck & Clore 2008, pp. 1830ff.). States of high arousal, as a consequence of defiant affective evaluation, are likely to trigger emotions, which are mostly defined as conscious, intensive and directed (Kleinginna & Kleinginna, 1981; Kuhl, 2001; Otto, Euler & Mandl, 2000; see Rausch et al., 2010 and Rausch, 2011, for details). Affects and emotions thus serve as a continual feedback on success and failure in need satisfaction and goal achievement and are therefore vital in any processes of problem solving. They enable priority setting and a reduction of complexity as well as the decoupling of stimuli-and-response patterns (Ciompi, 2007; Scherer, 1981, 1994; Sembill, 2003).

As positive emotions – from a functional perspective – serve as a reward for past behavior and negative emotions call for changes in future behavior motivational facets of action regulation are realized in an interaction with affect and cognition as well (Kuhl, 2001; Sembill, 2003). Consequently, Smith and Kirby refer to emotions as a "sophisticated *well-being monitor and guidance system* that serves both attention-regulatory and motivational functions" (Smith & Kirby, 2000, p. 90; see also Carver, Sutton & Scheier, 2000). Any action would be irrelevant without the subjective values of the acting individual (Lewis, 1946), as these influence the perception and evaluation of (potential) goals, courses, and results of action (Emmons 1996; Sembill 1992). "There is no reason, other than an affective one, to prefer any goal whatever over some other. Cognitive reasoning may argue that a particular event could lead to loss of money or health or life, but so what?" (Frijda, 1994, p. 200).

Apart from the physiological needs inherent in all human beings (instincts; see above), there are universal psychological needs as well. According to the Self-Determination Theory (SDT) of motivation proposed by Deci and Ryan (1985; 2002), there are three basic human needs: (1) The need for autonomy, which refers to self-organization and the desire to perceive oneself as the origin of one's action. (2) The need for competence, which means the desire to be effective in one's interactions with the environment and in coping with challenging tasks in order to maintain and develop competences. (3) The need for social relatedness, which refers to the inherent desire to be accepted by other individuals and part of social groups. Though the intensity and the level of consciousness of these needs might differ between individuals, they are said to be present in all human beings. However, besides these basic needs, there are learned motives, interests, and intentions that might differ enormously between individuals but nevertheless are vital for action regulation. Besides,

these traits are largely open to consciousness, both domain-specific and concrete. As they are learned (or in terms of SDT: *internalized*) as a consequence of basic need satisfaction in prior experiences, they are coherent concretions or extensions of basic needs. For instance, habitual interest in a certain domain points to positive prior experiences in that domain. In consequence, stimuli from that domain trigger positive affects potentially resulting in conscious emotions (such as situational interest). To summarize, affects and emotions have a seismographic function in action regulation, which can be explained by neurophysiological findings as well (Schumacher, 2002; Sembill, 2003, 2010).

The extent, to which internalized values have an influence on performance, and thus have to be considered as a facet of competence, may vary with regard to a particular domain. The more a domain is artificially defined (e.g. by a formal curriculum, such as mathematics) instead of being generated by real-life practice, the more it lacks a real-life performance.[2] The performance in a math test should be an estimator for some kind of real-life performance in math, but instead, the test performance itself is the typical performance of that artificial domain. Unsurprisingly, the emotional and motivational facets that influence this performance refer to the typical test situation, such as test anxiety and test motivation, both strongly influenced by the impact of the particular test. These test-related emotions and motivations are neglected as part of mathematical competence, for good reason. On the other hand, domain-related values such as interest in math or preference for mathematical thinking are neglected as well though they might have a huge influence on future "mathematical practice". This neglect derives from a traditional preference for cognitive learning goals over affective ones.

In contrast to the above-mentioned domain of mathematics as a school subject, in working contexts the desired performances are more complex and less predictable. Though distal work goals are predefined by the organization, workplaces allow for varying scopes of action. Apart from differences in cognitive dispositions, within work psychology, the resulting variance of individual engagement is also considered to be caused by constructs such as organizational citizenship behavior (Nerdinger, Blickle & Schaper, 2008), personal initiative (Fay & Frese, 2001) and the idea that, besides formal norms and standards, organizations depend on the non-codified and voluntary engagement of their members (Smith, Organ & Near, 1983). These constructs, in turn, point to an individual's internalized subjective values (Nerdinger, 1995). Hence, we argue that in order to explain performance in real-life work tasks (i.e. modeling and measuring competence), non-cognitive facets should be taken into account in terms of an integrated approach.

NON-COGNITIVE FACETS IN MODELING AND MEASURING COMPETENCE

As mentioned at the beginning, there are several ways of dealing with non-cognitive facets in modeling and measuring competence, ranging from wide neglect to integrated recognition within performance. In order to understand the functionality of

human intentional behavior a boost was given to research and literature on processes of thinking and problem solving as a result of the paradigm shift referred to as the "cognitive turn" which occurred in the middle of the last century. Overcoming the black-box metaphor of the behaviorist perspective, several groundbreaking works appeared, such as Bruner, Goodnow and Austin (1956), Miller, Galanter and Pribram (1960), Chomsky (1965), Newell and Simon (1972) and Neisser (1974) within western psychology, as well as the works of Rubinstein, Vygotski, Galperin, Leont'ev, Oschanin etc. within Soviet psychology (Matthäus, 1988). With regard to Germany, the works of Dörner (1976), Hacker (1978), Scherer (1981) and Aebli (1980) should also be highlighted as exemplary. Already at that time it had become apparent that the grasp of cognition as well as the certain view of the relevance of non-cognitive constructs was considered differently depending on the particular author. For example, Dörner was one of the first researchers to stress the significance of emotions in thinking and problem solving, whereas Aebli considered emotions to be merely disturbing variables.

In most of the international literature, the definition of cognition goes beyond the common definition in German literature. Instead of distinguishing cognition, emotion and motivation on the same level, the definition of cognition is often expanded to cover all internal processes, including emotion and motivation. Nevertheless, many of the early works stress the significance of evaluations, judgements, values, preferences etc. without going into detail. Nowadays the evidence of neurophysiological findings contributes to the overcoming of cognitivist approaches in the narrow sense. The relevance of emotional and motivational facets for understanding competent acting in real-life situations is widely accepted, but rarely investigated empirically. In the previous sections, we emphasized the necessity of broadening the modeling and measurement of competence to integrate non-cognitive facets. Consequently and importantly, it is necessary to translate the basic principles of action regulation theory into a consistent model of competence in a specific domain.

A competence model in the narrow sense merely consists of a definition of a set of individual dispositions. There are neither statements made on what kind of performance is expected to be derived from the respective competence nor does it include reflections on the implications of the domain. In contrast, competence models in a broader sense comprise of a domain model of requirements, a competence model of individual dispositions (i.e. a competence model in the narrow sense), and an empirical model of measurement. Furthermore and most significantly, consistent statements on the relationship of these three model layers are needed because defining and measuring competences always means that some kind of (test) performance serves as an estimator for further (real-life) performances in the respective domain. Consequently, in order to trace test performance back to singular facets of competence, it is necessary to assign particular test behavior to particular facets of competence. Otherwise, it would remain unclear which facets of competence produced the test performance or, in other words, a singular test score would conflict with a multifaceted construct.

As a result, developing integrated measurements for a multifaceted construct in order to analyse test behavior regarding the particular facets raises the question: Which test behavior points to which facet of competence and to what extent? This problem of translation is further aggravated as performance is not necessarily a bijective function of the underlying competence (Chomsky, 1965), but may be produced by varying combinations of trait facets. Hence, measuring a multifaceted construct also includes the problem of dealing with certain interrelations and possible effects of compensation between the different conceptualised facets. For example, one could ask whether, within future work situations, a short-term lack of knowledge might be compensated for by interest and engagement? On the other hand, is a competent testee necessarily more interested and contented? Again, this is subject to the perspective of modeling competences in the face of theoretical implications and the underlying grasp of education in general.

Thus, within the investigation of competence, four major ways of handling dimensionality in modelling and measurement may be distinguished (see Figure 1): (A) *Modeling and measuring competence as a unidimensional construct.* This approach implicates an antiquated and simplistic view of human behavior. A narrow perspective on capabilities often corresponds with a narrow domain of application or an otherwise mediocre prognosis of performance. (B) *Modeling competence as a fragmented construct and disregarding non-cognitive facets in measurement*. This approach does not explicitly neglect the meaning of non-cognitive facets, but nevertheless, it does not include them in its measurements. This approach is preferred, for example, within the current priority research program of the German Research Foundation entitled "Competence Models for Assessing Individual Learning Outcomes and Evaluating Educational Processes" (Klieme & Leutner, 2006; Hartig, Klieme & Leutner, 2008 et passim).

The program, so far, provides a lot of interesting findings, which, however, are based on the assumption of the outstanding significance of cognitive parameters in competent acting, while non-cognitive facets are not included as a focus of attention. (C) *Modeling competence as a multifaceted construct and measuring non-cognitive facets as separated from cognitive facets*. An example of this approach can be found in the modeling of professional competences of teachers within the study "COACTIV" initiated by Baumert and colleagues (Baumert & Kunter, 2006; Kunter et al., 2007; Kunter & Klusmann, 2009). Non-cognitive facets such as attitudes are measured by self-report questionnaires that remain separated from the actual performance context. Therefore, the influence of these facets on solving domain-specific problems might be underestimated.

Nevertheless, the results might show interrelations between cognitive and non-cognitive traits on a general level. A similar approach is posed in the feasibility study of a large-scale assessment within VET (Baethge et al., 2006). (D) *Modeling competence as a multifaceted construct and measuring cognitive and non-cognitive facets integrated*. This approach is rarely applied and is limited to laboratory studies. However, we have striven to implement it within our current study[3] because it is

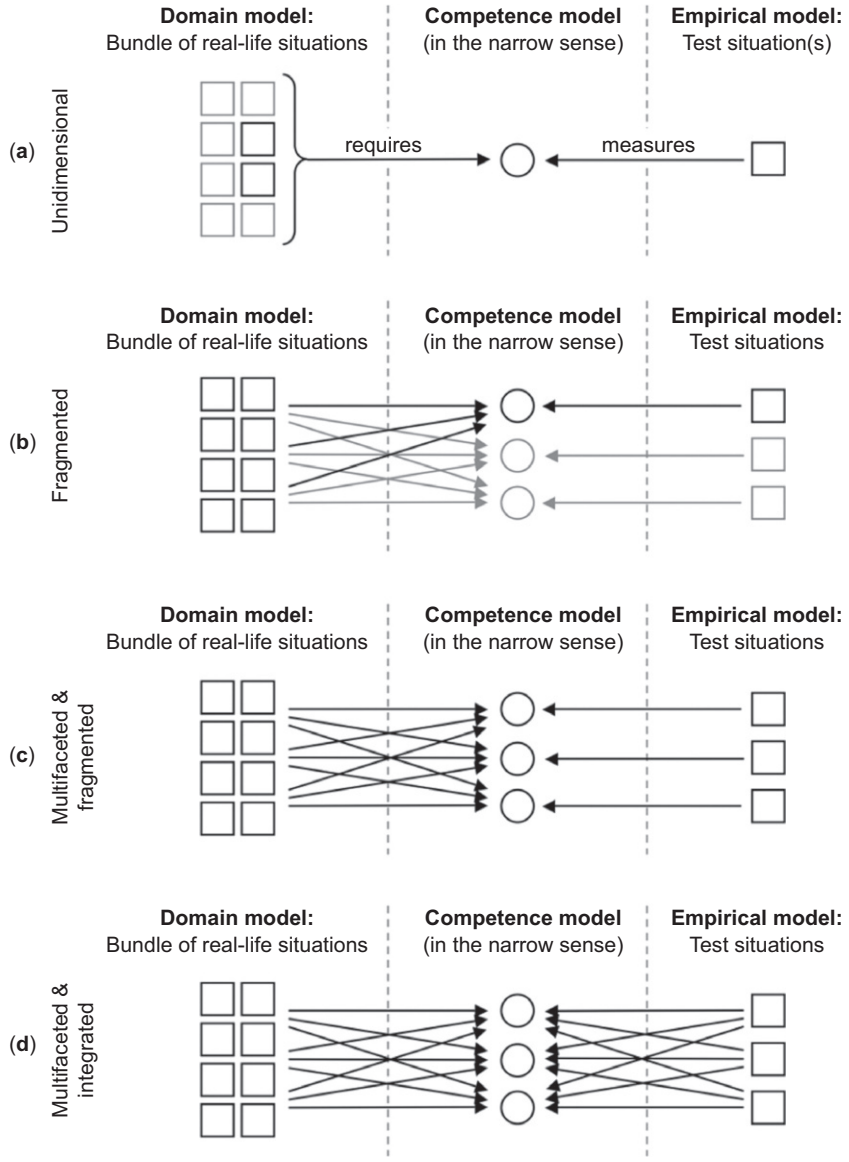

Figure 1. Types of competence models (in the broader sense).

more in line with theories of action regulation and, therefore, to our mind, promising with regard to ecological validity. Nevertheless it also raises several methodological questions, some of which will be provisionally addressed in the following section, however, without providing an exclusive solution yet.

PROSPECTS FOR AN INTEGRATED MEASUREMENT OF COMPETENCE

A multifaceted model and integrated measurement of competence (see model D in Figure 1) demands some very complex inferences. A suitable model would have to provide detailed explanations for (i) which step in which real-life situation requires which competence facet and (ii) which step of a test situation measures which competence facet. Furthermore, (iii) it would have to consider the probability of compensation between the facets. Given the complexity, dynamics, and interaction of prerequisites, processes, and products of thinking, problem solving, and acting (see above), neither current analytic frameworks nor empirical methods seem to meet the necessary requirements.

Common approaches of competence measurement pose a more or less complex problem to the testees and assess the result they achieve. There is an exclusive focus on the product, whereas the process of problem solving remains a black box. This is a typical characteristic of mental work, as opposed to physical or practical work, in which the emergence of a product is observable. However, in both contexts, the solution to a problem, to our mind, is not only a product of applied knowledge and skills, but also a result of emotional and motivational processes while applying knowledge and skills. Goal setting, goal commitment, sustained engagement, etc. can hardly be explained by specific knowledge or general cognitive abilities alone. Thus, it is vital to try to open up the black box of problem-solving processes.

In order to gain insight into the process of problem solving, a self-evident method is to question the testees while they are working on the problem. An extreme form of self-reporting would be think-aloud protocols. Though the collected data allows for intensive insights into problem-solving processes, there are at least three reasons against it. Firstly, this method is a heavy intrusion into the respective processes and, thereby, is likely to change the processes (reactivity). Secondly, as a consequence of this, reactance in terms of intentional refusal might result. Thirdly, the analyses of the data collected call for extensive work. Large scale assessments are confronted with the problem in a particular way as the empirical analysis of a huge number of data sets requires efficient and streamlined procedures. Thus, methods applied to unveil problem solving should be as subtle as possible. Prompts for providing information into the current state of the problem-solving process should be embedded into the problem situation, thereby concealing the perception of it as an artificial add-on. Nevertheless, there are several uncertainties related to those prompts. At first, the ability to give adequate self-reports might be limited and is likely to vary individually. In addition, a desired feature of testing is that the testee can manipulate the results only in one direction, namely downwards. When using self-reports for high-stake testing, this becomes a problem because the likelihood of manipulation increases. Embedding prompts into the authentic problem scenario might also help decrease manipulation.

Furthermore, the problem situations should be as authentic as possible, not only with regard to the knowledge and skills required in real life, but also with regard to

possible effects of non-cognitive factors. For example, in working contexts there is often the possibility to fix a problem only on the surface without turning towards its deeper sources. Moreover, there are sometimes possibilities to completely ignore or delegate problems, especially if there is still other (more attractive) work to do. Test situations should represent such characteristics in order to make the effects of non-cognitive influences more visible.

At present, a predefined competence model providing well founded hypotheses on all possible interactions and compensations of various facets of competence (as stated in model D within Figure 1) seems to be some distance away. Nevertheless developing item formats and test items with respect to a variety of competence facets provide possibilities for confirming such facets and, thereby, advancing the theoretical debate.

To summarize, an integrated modeling and measurement of cognitive and non-cognitive facets is a worthwhile but, at the same time, a challenging task. One could argue whether a bijective mapping between single facets of test behavior and single facets of underlying competence, as proposed in the integrated approach (D), is feasible at all for the distinction between cognition and affect remains artificial. Moreover, as we know from Aristotle, the whole is more than the sum of its parts but is something else. Nevertheless, we have here introduced initial considerations as to how to overcome this dilemma by applying a less rigorous modeling approach. In the long run, pursuing holistic approaches to competence measurement might help to direct attention to what are currently neglected non-cognitive goals of vocational education.

NOTES

[1] Some authors refer to such broad understandings in terms of competency, as opposed to competence as a more narrow, merely functional perspective (Delamare-Le Deist & Winterton, 2005). However, we do not adopt this distinction.

[2] Therefore, one could argue whether "domains" such as math as a school subject are still in line with the definition of a domain.

[3] "Domain-specific Problem Solving Competence of Industrial Administrators in Training" (DomPL-IK) is a joint research project of the universities of Bamberg, Mannheim, Frankfurt and Bremen and the German Institute for International Educational Research (DIPF), which is a part of the Ascot program founded by the German Ministry of Education and Research. It aims at technology-based assessment of problem solving competences of apprentices becoming industrial clerks (*Industriekaufleute*, IK) within the domain of control.

REFERENCES

Achtenhagen, F. (2007). Wirtschaftspädagogische Forschung zur beruflichen Kompetenzentwicklung. In J. van Buer, & C. Wagner (Eds.) *Qualität von Schule - Ein kritisches Handbuch*. Frankfurt: Peter Lang, 481–494.

Aebli, H. (1980). *Denken: das Ordnen des Tuns. Band I, Kognitive Aspekte der Handlungstheorie*. Stuttgart: Klett-Cotta.

Baer, M. F., Connors, B. W., & Paradiso, M. A. (2009). *Neurowissenschaften. 3. Auflage*. Heidelberg: Spektrum.

Baethge, M., Achtenhagen,F., Arends, L., Babic, E., Baethge-Kinsky, V., & Weber, S. (2006). *PISA-VET - A Feasibility Study*. Stuttgart: Steiner.

Baumert, J., & Kunter, M. (2006). Stichwort: Professionelle Kompetenz von Lehrkräften. *Zeitschrift für Erziehungswissenschaft, 9*(4), 469–520.

Birbaumer, N., & Schmidt, R. F. (2010). *Biologische Psychologie*. 7., vollständig überarbeitete und ergänzte Auflage. Heidelberg: Springer.

Breuer, K. (2006). Kompetenzdiagnostik in der beruflichen Bildung - eine Zwischenbilanz. *Zeitschrift für Berufs- und Wirtschaftspädagogik, 102*(2), 194–210.

Bruner, J. S., Goodnow, J. J., & Austin, G. A. (1956). *A study of thinking*. New York: Wiley.

Carver, C. S., Sutton, S. K., & Scheier, M. F. (2000). Action, emotion, and personality: Emerging conceptual integration. *Personality and Social Psychology Bulletin, 26*, 741–751.

Chomsky, N. (1965/1970). *Aspekte der Syntax-Theorie*. Frankfurt: Suhrkamp.

Ciompi, L. (2007). *Gefühle, Affekte, Affektlogik - Ihr Stellenwert in unserem Menschen- und Weltverständnis*. 2. Auflage. Wien: Picus.

Clore, G. (1994). Why emotions require cognitions. In P. Ekman, & R. Davidsson (Eds.) *The nature of emotion*. New York: Oxford University Press, 181–191.

Corsten, M. (2001). Berufsbildungsforschung in der Soziologie. In J. van Buer, A. Kell, & E. Wittmann (Eds.) *Berufsbildungsforschung in ausgewählten Wissenschaften und multidisziplinären Forschungsbereichen*. Frankfurt: Peter Lang, 53–106.

Damasio, A. (1995). *Descartes' Error: Emotion, Reason and the Human Brain*. New York: Avon.

Deci, E., & Ryan, R. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.

Deci, E., & Ryan, R. (2002). *Handbook of self-determination research*. Rochester: The University Press.

Delamare-Le Deist, F., & Winterton, J. (2005). What is competence? *Human Resource Development International, 8*, 27–46.

Dörner, D. (1976). *Problemlösen als Informationsverarbeitung*. Stuttgart: Kohlhammer.

Dörner, D., & Kaminski, G. (1988). Handeln - Problemlösen - Entscheiden. In K. Immelmann, K. R. Scherer, C. Vogel, & P. Schmoock (Eds.) *Psychobiologie. Grundlagen des Verhaltens*. Stuttgart: Gustav Fischer, 375–415.

Ellsworth, P. (1994). Some reasons to expect universal antecedents of emotion. In P. Ekman, & R. Davidsson (Eds.) *The nature of emotion*. New York: Oxford University Press, 150–154.

Emmons, R. A. (1996). Striving and feeling: Personal goals and subjective well-being. In P. M. Gollwitzer, & J. A. Bargh (Eds.) *The psychology of action. Linking cognition and motivation to behaviour*. New York: The Guilford Press, 313–337.

Erpenbeck, J. & von Rosenstiel, L. (2003). Einführung. In J. Erpenbeck, & L. von Rosenstiel (Eds.) *Handbuch Kompetenzmessung - erkennen, verstehen und bewerten von Kompetenzen in der betrieblichen, pädagogischen und psychologischen Praxis*. Stuttgart: Schäffer-Poeschel, IX-XI.

Fay, D., & Frese, M. (2001). The concept of personal initiative: An overview of validity studies. *Human Performance, 14*(1), 97–124.

Frijda, N. (1988). The laws of emotion. *American Psychologist, 43*(5), 349–358.

Frijda, N. (1994). Emotions require cognitions, even if simple ones. In P. Ekman, & R. Davidsson (Eds.) *The nature of emotion*. New York: Oxford University Press, 197–292.

Gadenne, V. (1996). *Bewusstsein, Kognition und Gehirn. Einführung in die Psychologie des Bewusstseins*. Bern: Hans Huber.

Hacker, W. (1978). *Allgemeine Arbeits- und Ingenieurspsychologie*. 2. Auflage. Bern: Hans Huber.

Hartig, J., Klieme, E., & Leutner, D. (2008). *Measuring competencies: Introduction to concepts and questions of assessment in education*. Göttingen: Hogrefe.

Kleinginna, P., & Kleinginna, A. (1981). A categorized list of emotion definitions, with suggestions for a consensual definition. *Motivation and Emotion, 5*(4), 345–379.

Klieme, E., Avenarius, H., Blum, W., Döbrich, P., Gruber, H., Prenzel, M. et al. (Eds.) (2003). *Expertise zur Entwicklung nationaler Bildungsstandards*. Berlin: BMBF.

Klieme, E., & Leutner, D. (2006). Kompetenzmodelle zur Erfassung individueller Lernergebnisse und zur Bilanzierung von Bildungsprozessen. Beschreibung eines neu eingerichteten Schwerpunktprogramms der DFG. *Zeitschrift für Pädagogik, 52*(6), 876–903.

Kuhl, J. (2001). *Motivation und Persönlichkeit - Interaktionen psychischer Systeme.* Göttingen: Hogrefe.

Kunter, M., & Klusmann, U. (2009). Professionelle Kompetenz von Mathematiklehrkräften: Das COACTIV-Modell. In O. Zlatkin-Troitschanskaia, K. Beck, D. Sembill, R. Nickolaus, & R. Mulder (Eds.) *Lehrprofessionalität – Bedingungen, Genese, Wirkungen und ihre Messung*. Weinheim: Beltz, 153–165.

Kunter, M., Klusmann, U., Dubberke, T., Baumert, J., Blum, W., Brunner, M.; et al. (2007). Linking aspects of teacher competence to their instruction. Results from the COACTIV Project. In M. Prenzel (Ed.) *Studies on the educational quality of schools. The final report on the DFG Priority Programme*. Münster: Waxmann, 32–52.

Lazarus, R. S., Kanner, A. D., & Folkman, S. (1980). Emotions: A cognitive-phenomenological analysis. In R. Plutchik, & H. Kellerman (Eds.) *Emotion. Theory, research and experience*. Vol. 1: Theories of Emotion. New York: Academic Press, 189–217.

LeDoux, J. E. (1994). Emotion, memory and the brain. *Scientific American, 270*(6), 50–57.

Lehmann, R., & Seeber, S. (2007). *Ulme III. Untersuchung von Leistungen, Motivation*.

Leventhal, H., & Scherer, K. R. (1987). The relationship of emotion to cognition: A functional approach to a semantic controversy. *Cognition and Emotion, 1*(1), 3–28.

Lewis, C. I. (1946). *An analysis of knowledge and valuation*. LaSalle: Open Court Publishing Co.

Matthäus, W. (1988). *Sowjetische Denkpsychologie*. Göttingen: Universität.

Miller, G. A., Galanter, E., & Pribram, K. H. (1960). *Plans and the structure of behaviour*. New York: Holt Rinehart & Winston.

Neisser, U. (1974). *Kognitive Psychologie*. Stuttgart: Ernst Klett.

Nerdinger, F. W. (1995). *Motivation und Handeln in Organisationen. Eine Einführung*. Stuttgart: Kohlhammer.

Nerdinger, F. W., Blickle, G., & Schaper, N. (2008). *Arbeits- und Organisationspsychologie*. Heidelberg: Springer.

Newell, A., & Simon, H. A. (1972). *Human problem solving*. Englewood Cliffs: Prentice-Hall.

Otto, J., Euler, H., & Mandl, H. (2000). Begriffsbestimmungen. In J. Otto, H. Euler, & H. Mandl (Eds.) *Emotionspsychologie - Ein Handbuch*. Weinheim: Psychologie Verlagsunion, 11–18.

Panksepp, J. (1998). *Affective neuroscience: The foundations of human and animal emotions*. Oxford: Oxford University Press.

Rausch, A. (2011). *Erleben und Lernen am Arbeitsplatz in der betrieblichen Ausbildung*. Wiesbaden: VS Verlag.

Rausch, A., Scheja, S., Dreyer, K., Warwas, J., & Egloffstein, M. (2010). Emotionale Befindlichkeit in Lehr-Lern-Prozessen - Konstruktverständnis und empirische Zugänge. In J. Seifried, E. Wuttke, R. Nickolaus, & P. F. E. Sloane (Eds.) Lehr-Lern-Forschung in der kaufmännischen Berufsbildung - Ergebnisse und Gestaltungsaufgaben. *Beiheft 23 der Zeitschrift für Berufs- und Wirtschaftspädagogik*. Stuttgart: Franz Steiner, 193–215.

Ruiz-Primo, M. A. (2009). Towards a Framework for Assessing 21st Century Science Skills. White Paper. Washington DC: The National Academies. Retrieved from http://www7.nationalacademies.org/bose/Ruiz_Primo_21st_Century_Paper.pdf.

Rychen, D. S., & Salganik, L. H. (2003). A holistic model of competence. In D. S. Rychen, & L. H. Salganik (Eds.) *Key competencies for a successful life and well-functioning society.* Göttingen: Hogrefe & Huber, 41–62.

Scherer, K. R. (1981). Wider die Vernachlässigung der Emotionen in der Psychologie. *Bericht über den 32. Kongress der Deutschen Gesellschaft für Psychologie, 1*, 304–317.

Scherer, K. R. (1994). An Emotion's Occurrence Depends on the Relevance of an Event to the Organism's Goal/Need Hierarchy. In P. Ekman, & R. Davidson (Eds.) *The Nature of Emotion*. New York: Oxford University Press, 227–231.

Scherer, K. R. (1999). Appraisal theory. In T. Dalgleish, & M. Power (Eds.) *Handbook of Cognition and Emotion*. Hoboken: John Wiley & Sons, 637–663.

Schumacher, L. (2002). *Emotionale Befindlichkeit und Motive in Lerngruppen*. Hamburg: Dr. Kovac.
Schwarz, N. (1990). Feelings as information: Informational and motivational functions of affective. In E. T. Higgens, & R. M. Sorrentino (Eds.) *Handbook of motivation and cognition. Foundations of Social Behaviour*. Volume 2. New York: The Guilford Press, 527–561.
Sembill, D. (1992). *Problemlösefähigkeit, Handlungskompetenz und Emotionale Befindlichkeit*. Göttingen: Hogrefe.
Sembill, D. (1995). Research Learning: How to get Top Students. In R. Olechowski, & G. Svik (Eds.) *Experimental Research on Teaching and Learning*. Bern: Lang, 129–146.
Sembill, D. (2003). Emotionale Befindlichkeit als bestimmende und sinngebende Voraussetzung von Lern- und Lebenswirklichkeit. In J. van Buer, & O. Zlatkin-Troitschanskaja (Eds.) *Berufliche Bildung auf dem Prüfstand - Entwicklung zwischen systemischer Steuerung, Transformation durch Modellversuche und unterrichtlicher Innovation*. Band 5. Frankfurt: Peter Lang, 181–205.
Sembill, D. (2010). Emotionen in ihrer Funktionalität für das Lernen. In R. Nickolaus, G. Pätzold, H. Reinisch, & T. Tramm (Eds.) *Handbuch Berufs- und Wirtschaftspädagogik*. Bad Heilbrunn/Obb.: Klinkhart, 80–84.
Sloane, P. F. E. (2008). Vermessene Bildung - Überlegungen zur Entwicklung des Deutschen Qualifikationsrahmens. *Zeitschrift für Berufs- und Wirtschaftspädagogik, 104*(4), 481–502.
Smith, C. A., & Kirby, L. D. (2000). Consequences require antecedents: Toward a process model of emotion elicitation. In J. P. Forgas (Ed.) *Feeling and thinking. The role of affect in social cognition*. Cambridge.: Cambridge University Press, 83–108.
Smith, C. A., Organ, D. W., & Near, J. P. (1983). Organizational citizenship behaviour: its nature and antecedents. *Journal of Applied Psychology, 68*(4), 653–663.
Spencer, L. M., McClelland, D., & Spencer, S. M. (1994). *Competency assessment methods. History and state of the art*. Boston: Hay/McBer Research Press.
Storbeck, J., & Clore, G. L. (2008). Affective arousal as information: How affective arousal influences judgements, learning, and memory. *Social and Personality Psychology Compass, 2*(5), 1824–1843.
van Reekum, C. M., & Scherer, K. R. (1997). Levels of Processing in Emotion - Antecedents Appraisal. In G. Matthews (Ed.) *Cognitive Science Perspectives on Personality and Emotion*. Amsterdam: Elsevier, 259–300.
von Cranach, M., & Bangerter, A. (2000). Wissen und Handeln in systemischer Perspektive. Ein komplexes Problem. In H. Mandl, & J. Gerstenmaier (Eds.) *Die Kluft zwischen Wissen und Handeln. Empirische und theoretische Lösungsansätze*. Göttingen: Hogrefe, 221–252.
Weinert, F. E. (2001). Vergleichende Leistungsmessung in Schulen - eine umstrittene Selbstverständlichkeit. In F. E. Weinert (Ed.) *Leistungsmessungen in Schulen*. Weinheim: Beltz, 17–31.
Winther, E. (2010). *Kompetenzmessung in der beruflichen Bildung*. Bielefeld: Bertelsmann.
Wuttke, E. (1999). *Motivation und Lernstrategien in einer selbstorganisationsoffenen Lernumgebung. Eine empirische Untersuchung bei angehenden Industriekaufleuten*. Frankfurt: Peter Lang.

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