Dealing with Conceptualisations of Learning
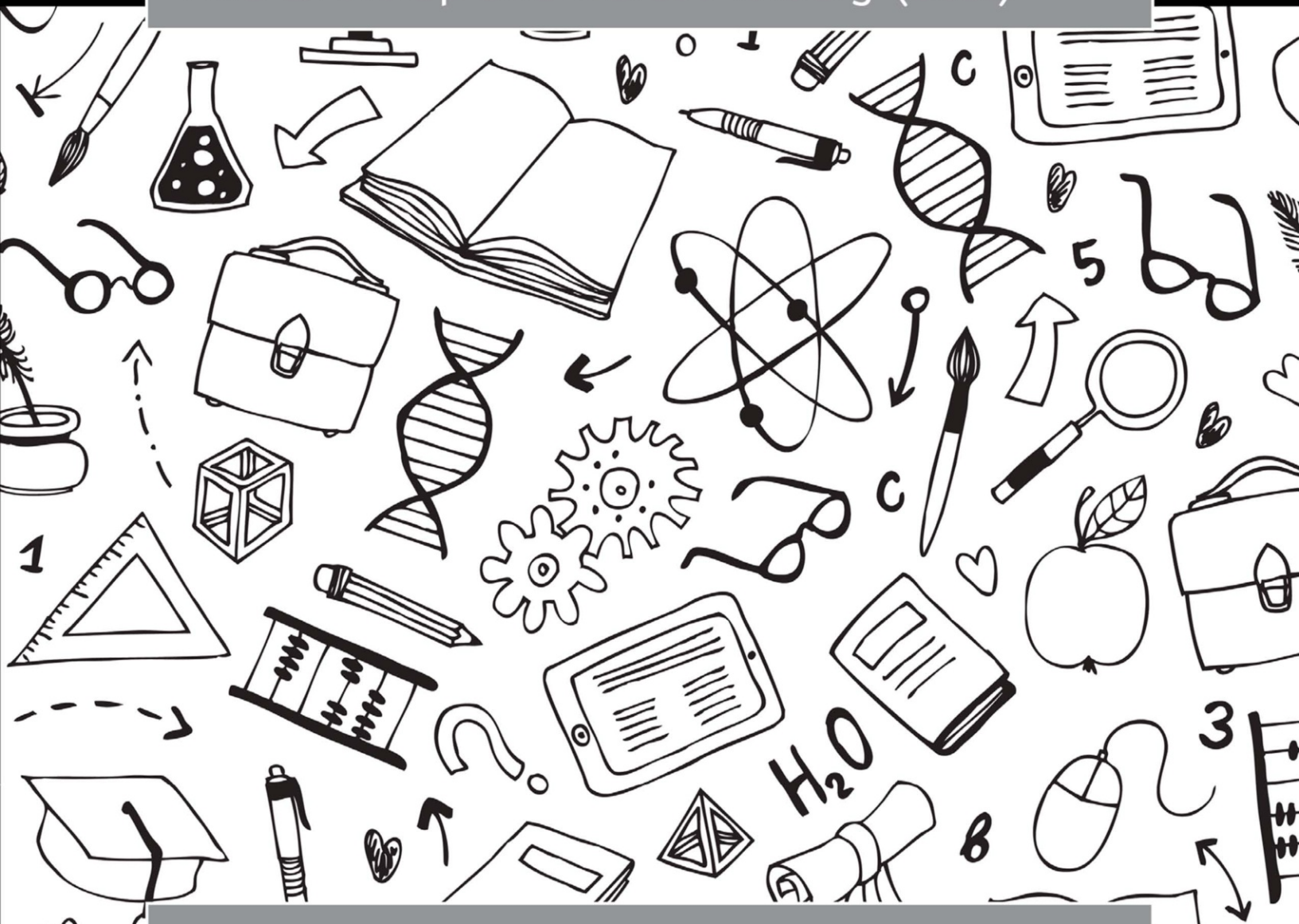
Learning between Means and Aims in Theory and Practice

Ane Qvortrup and Merete Wiberg (Eds.)

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1. LEARNING BETWEEN MEANS AND AIMS

INTRODUCTION

An increased political and professional interest in learning has manifested itself in a shift from content-based to outcome-based curricula and in an increased focus on evidence-informed teaching. Within schools, among teachers and in the overall field of education, the paradigmatic shift from content-based to outcome-based curricula has been followed by enhanced interest in, as well as debate about, how learning outcomes are operationalised into learning objectives or targets in study regulations and syllabus/lesson plans, and in formalised assessment of learning. The political focus on evidence-informed teaching and learning has manifested itself in an enhanced focus on the quality of teaching and teaching methods, including an interest in a summative assessment of learning. Educational research on evidence-informed teaching claims the relevance of an enhanced focus on transparency in expected learning targets and on an assessment of the effect of teaching and teaching methods on learning. However, research also clearly underlines that teachers' and students' interpretation and sense-making, as well as their process-related and formative assessment of learning, play a fundamental role in what students' learn (Bryk, Gomez, Grunow, & LeMahieu, 2015; Rønsen, 2014). Furthermore, it is obvious that in practice, didactisation, i.e. reflection on teaching, and ongoing re-didactisation, where teachers change track in teaching due to unforeseen situations, opportunities or challenges, both take place (Hansen, 2006, 2010; Heyerdal-Larsen, 2000; Skjeldbred, Solstad, & Aatmosbakken, 2005).

This book addresses the multiple aims/means structure in educational processes of learning. Learning happens everywhere. When dealing with learning in educational contexts, means and aims always have both a normative and an instrumental content. An aim might be that students are able to read and write. The explicit or implicit normative content of this could be to get a job, to prepare students for participating in a democratic society, or to become able to enjoy literature. The instrumental content might be to differentiate between nouns and verbs, or to use invented spelling. Furthermore, in educational contexts, learning always actualises itself in terms of methods and targets and must be viewed from a teacher's as well as a student's perspective. We understand learning as a phenomenon, which is only possible to derive from observation or people's reports. It is impossible to 'see' the essence of learning in itself. In order to get a grip of learning, researchers and practitioners might use models or metaphors, as for example Anna Sfard does in her paper 'Two

metaphors of learning' (Sfard, 1998). In this book, we deal with learning by using 'means' and 'aim' as metaphors, which, if viewed as intertwined, show a multiple structure of the phenomenon of learning. In educational contexts, we have both long-term aims and means of an educational process and short-term aims and means of a lesson. These are pursued by facilitating learning by means of teaching. Here, on the one hand, learning might be the result of teaching activities. On the other hand, learning describes various means that might be activated either by the teacher or the student, in order to facilitate, understand or evaluate the student's processes of learning. The teacher can use 'aims' and 'means' as a kind of tools to reflect and decide on different teaching strategies, while at the same time the teacher and perhaps also the student strive to bring about learning. As a means, learning is the description of something, which happens in a process, which aims at 'something'. In order to make 'something' happen, means must be operationalised into actions, in terms of habits or methods. As an aim, learning is the description of 'something' that 'somebody' (the student or the teacher) intends to be the target of a learning process. We will discuss how we are to understand the relationship between means and aims in the process of learning.

In order to get an analytical grip of learning as a phenomenon in teaching and within student/teacher interactions, this chapter conceptualises and discusses the multiple aims/means structure, which we assume characterise processes of learning that involve a teacher and a student.

HOW IS EDUCATION POSSIBLE AND HOW TO UNDERSTAND EDUCATION?

The purpose and core idea of teaching and didactics is the focus of renewed attention. The rise and development of didactics is closely related to a growing societal complexity and the consequent changes of – and uncertainty about – the purpose or aims of education (Qvortrup & Keiding, 2017). Furthermore, it is closely related to changes in – and increased uncertainty about – answers to the question, "how is it possible to educate"? This concerns the question of how means of education sometimes might eventually contrast with overall aims of education, such as freedom, democracy and autonomy (ibid.). This is related to the condition of teaching, or the so-called pedagogical paradox saying that teaching operates through outer influences, but is directed towards inner changes. The paradox is specified in relation to, on the one hand, the principle about the child's sensitiveness to formation or plasticity (Bildsamkeit) and on the other hand, the principle about the request for self-action (von Oettingen, 2001). According to Herbart, 'Bildsamkeit' is the foundational concept of education (Herbart, 1965[1841]: 165; English, 2013: 11) and education would not be possible or understandable without Bildsamkeit, because education requires the capacity to form as well as the sensitivity to be formed. Andrea English expresses it as follows: "The concept [Bildsamkeit] captures the individual's capacity to form and to be formed and thereby connects to the notion of Bildung" (2013: 12). The idea that the individual should have the capacities 'to form

and to be formed' might be helpful for the teacher's understanding of education, because it helps him to see that from the perspective of the student, teaching and learning involve active as well as passive dimensions. If we are to understand these passive and active dimensions, we need to dig deeper into teaching and learning as interactive processes between a teacher and the students. Furthermore, we need to conceptualise the content of these interactive processes. We will argue that the concepts of means and aims, in terms of a multiple aims/means structure, might be helpful in this endeavour. Therefore, we pose the following questions: How can we capture the meaning of means and aims in the institutionalised processes of learning, which involve interactions between individuals such as teachers and students? What do these concepts mean if we understand means and aims from the perspective of the students as well as the teachers? What are their most important elements? And what is the relationship between means and methods on the one hand, and aims, outcomes and targets on the other hand?

THE RELATIONSHIP BETWEEN TEACHING AND LEARNING

In order to discuss the relationship between means and aims, we must first understand the ongoing development of the understanding of the relationship between teaching and learning. Since the end of the last century, the phenomenon of learning has received increasingly more attention. According to A. Hargreaves (2003), this change is linked to globalisation, the emergence of 'the knowledge society' and an enhanced focus on innovation and creativity. Knowledge and learning are considered to be fundamental resources for future development. The focus on learning, however, must be understood in light of the developments in the Western world that already happened in the early part of the 20th Century. The so-called 'second industrial revolution' demanded an educated work force and this led to a view of workers as 'human capital' (Becker, 1964; Mincer, 1958). In relation to the increased interest in learning, a great variety of new concepts of learning appeared. One difficulty involves coming to terms with constantly changing definitions of learning (Qvortrup, Wiberg, Christensen, & Hansbøl, 2016). As argued by Qvortrup and Keiding (2016), the preoccupation with learning activities and concepts like "students as chief agents or constructors of their own learning" and "from teaching to learning" seems to have changed how we talk (and think?) about teaching. Some researchers consent that the new orientations have guided the attention away from teaching, and consequently from the discipline didactics and theories of instruction, towards the learner and learning strategies, and have placed activities referring to learning on the centre stage (Haugsbakk & Nordkvelle, 2007; Richardson, 2003; Terhart, 2003). According to Biesta (2012: 37), we have witnessed a new language of learning in the education system and a shift from teaching to "teachingandlearning", which he deliberately writes as one word, as this is how many people seem to use it nowadays. The consequence is a "learnification" of the education system (Biesta, 2010). Another difficulty, therefore, relates to the

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question of how to understand learning and teaching in schools as two mutually related but independent phenomena. This is no simple matter, and often the attempts to establish connections between the concepts or understandings of learning and teaching are based on educational designs attached to particular views of knowledge and learning. Examples of this can be found in some (social) constructivist theories of teaching activities, which take their point of departure as the view that knowledge and learning are always socially situated and arise from collective and personal constructions (Lave & Wenger, 1991). Manifold teaching or pedagogical patterns, such as student-oriented inquiry teaching, problem-based teaching, cooperative learning and computer-supported collaborative teaching, have been conceived and referred to as if they inherently belong to particular social constructivist notions of knowledge and learning. Several of these attempts tend to focus on the teachers' proactive efforts to design teaching activities that facilitate student learning through encouraging individual and collaborative/cooperative efforts to construct knowledge (Keiding & Qvortrup, 2015; Hattie, 2009: 26; Cobb, 2007: 5).

The starting point of this book is that in educational institutions, one reduces analytical extent and potential if the duality of learning and teaching is placed in a hierarchy, or if one side colonises the other. The two sides are mutually dependent and do not enter into a superior/subordinate relationship with each other. As Dewey says in the two versions of his book, *How we think* (1991[1910]: 29; 1986[1933]: 140): one might as well contend to have sold without anyone having bought than to contend having taught without anyone having learned. When we talk about learning without relating to teaching, we move outside the domain of school and teaching, and when we talk about teaching without relating to learning, we talk about teaching while turning a blind eye to its aim. Furthermore, it will always be the case that teachers as well as students are part of the landscape, although the relationship may function in various ways. In the educational landscape, teachers deal with aims and means in order to influence the students' processes of learning, while at the same time, students perhaps deal with other aims and means.

An example might be useful. Teaching children to read short texts might be the aim of the teacher in a classroom. The teacher's idea of a means for learning to read short texts may be certain reading strategies, such as direct instruction on background knowledge, graphic organisers, text structure, paraphrasing, or summarisation (Watson, Gable, Gear, & Hughes, 2012). The aim of the teacher (the child is able to read the short text), if understood by the student, may influence the learning process of the student, but the striving of the student does not necessarily mirror the reading strategy suggested by the teacher. Furthermore, the child might not be interested in, or even understand, the aim and means of the teacher. The idea is not to simplify the very complicated play between teacher(s) and student(s), but to clarify the many perspectives involved when dealing with aims and means in education.

The example illustrates that aims and means do not necessarily mean the same for the teacher and the student. Learning is not necessarily a direct consequence

of teaching, but the educational landscape consists of teaching as well as learning distributed between students and teachers, with many conceptions of means and aims in play. This manifold structure of aims and means we will call the multiple aims/means structure in order to point to teacher as well as student perspectives. The idea is that in order to be able to identify and structure teaching and learning aims, it is necessary to focus on the multiple aims/means structures of learning.

An Analysis of the Concepts Means and Aim

In the previous section, we addressed the multiple aims/means structures, which, we assume, characterise processes of learning in educational settings. In the following, we will firstly discuss the concepts of aims and means and then move on to develop a conceptual framework for the features of the very complex landscape of aims and means in the interaction between teachers and students.

In the introduction, we referenced Dewey for saying that teaching that does not relate to learning is turning a blind eye to its aim. In this, he agrees with Luhmann. According to Luhmann (2006: 81), the aim of educating (that is bringing up and learning) is what defines education. He says that interaction without an intention to educate does not count as teaching. However, both Dewey and Luhmann acknowledge that different aims emerge within teaching (Keiding & Qvortrup, 2014). One may differentiate between the planned, the taught and the experienced aims (Hopmann & Künzli, 1994; Kelly, 2009), and between the explicit and implicit/ tacit or hidden aims (Kelly, 2009), which are shaped by personal, societal or cultural norms and values (Heimann, 1976; Olteanu & Olteanu, 2013) and subjective theories and epistemological assumptions (Helmke, 2013). According to John Dewey education as such has no aims – only persons have aims (Dewey, [1985]1916: 114). He differentiates between the aims of the teacher and the aims of the students and makes the assertion that:

> It is as absurd for the latter [the teacher] to set up their "own" aims as the proper objects of the growth of the children as it would be for the farmer to set up an ideal of farming irrespective of conditions. Aims mean acceptance of responsibility for the observations, anticipations and arrangements required in carrying on a function…. (Dewey, 1985: 114)

How is this statement of Dewey to be understood? Dewey suggests that the teacher should deal with aims and means. But he also emphasises that the teacher must strive to make the aims and means, in concrete processes of learning, become the aims and means of the students.

> There is also an inclination to propound aims which are uniform as to neglect the specific powers and requirements of an individual, forgetting that all learning is something which happens to an individual at a given time and place. (Dewey, 1985: 115)

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Then, what does it mean, when we say that teaching and learning might *be directed by* aims, and how can we understand the relationship between aims and means? Is it the case that means only exist in relation to an aim and vice versa? Would it make sense to discuss aims in education without discussing means?

Regarding the first question about the directedness towards aims, as mentioned at the beginning of this chapter, in recent years we have witnessed a revitalisation of the dormant interest in how aims are operationalised into learning targets in study regulations and lesson plans (Biggs & Tang, 2011; Guskey, 2013; Redelius & Hay, 2012). Within the framework of this book, this operationalisation cannot be understood as a one-way process, but as manifold processes where teachers, students and teaching go through an operationalisation of different aims and direct themselves towards specified targets. These targets are not solitary and simple. Furthermore, the directedness towards targets does not say anything about the effect of aims and means, or about the relationship between a point of origin and a terminal point. On one hand, this relates to the presence of the multiple aims in the concrete practices. Practice is also justified by moral, social, and educational reasons, among others (Kvernbekk, 2011: 522). On the other hand, it relates to the fact that the inclination towards aims and targets is not about the realisation of causal relationships, but about directedness and reflection on effectiveness, justified by *how* (not *if*) gains in learning compare to prespecified targets. One may argue that the function of aims and targets is support. We might say that aims and targets function as support for the teacher as well as the students.

The Double Aim/Means Structure of Learning

Learning is a phenomenon which we cannot observe directly and which, on the one hand, is spoken of as the aim and maybe the result of teaching activities and, on the other hand – we must assume – describes various activities, which lead to the achievement of learning 'something'. From the perspective of the teacher, learning might be analysed in terms of aims and means in order to find suitable means for the achievement of the students. Aims and means are concepts the teacher uses to reflect and decide on different teaching strategies.

The analysis is complicated due to the perspectives we must include; namely the perspective of the teacher and the perspectives of the students. It might be illustrated as in the figure below:

It is important to notice that the aims and means intended by the teacher might not be the aims and means intended or experienced by the students.

If we look at means as the motor of learning it is relevant to focus on the relationship between the means of the teachers and the means of the student. Furthermore, we must look at the relationship between the aim of the teacher and the aim of the student.

We believe that this double aims/means structure can help identify the phenomenon of learning in relation to teaching. The idea is to understand the relationship between

Table 1. Aims and means

	Aim	*Means*
	Aims might be specified into targets	*Means might be operationalized into methods that perhaps turn into habits*
Teacher perspective	Teacher intentions. The teacher might have an idea or image of an aim or target for learning– for example how to do something in an excellent way.	Means the teacher is using in the classroom and which she assumes will help the student to learn, such as for example instruction methods or explanations.
Student(s) perspective	Something inherent in the process of learning, which might not yet be unfolded because it is dependent of what is going on in the situation. The student may not be aware of the aim.	Means as something which moves the process of learning and which is the motor of change. The student may not be aware of the means.

the means that the teacher are stating and using and the means which are actually part of the student's process of learning and which might be part of how the aim of learning is structured. In empirical studies, the idea might be to combine actual processes of learning with teacher intentions of learning and to discuss whether teacher methods and means actually make sense. Put in another way: Is there a match between the means used by teachers and the means that might be identified in the learning process of the student? Furthermore, is there a match between the aims of the teacher and the aims and means of the student? These questions need to be investigated in empirical research. In this book, our intention has been to sketch out a framework, which might be useful in empirical research.

The next chapter, Chapter 2 'Prerequisites of learning from various means and aim perspectives' by Merete Wiberg and Ane Qvortrup, focuses on how aims and means might be understood as prerequisites and conditions of learning. The chapter also focuses on and analyses how various prerequisites influence the way students and teachers perceive aims and means of learning. Prerequisites for learning are divided into three categories in order to deal with the following three perspectives: (1) the child/student perspective (2) the teacher perspective and (3) the shared context of the student and the teacher. In the first category, concerning the perspective of the child/student, 'meaningfulness' and 'persistence' are addressed as complex aims and means of learning. In the second category, the 'teacher's view on learning' and 'teacher's reflection and listening' are addressed. And in the third category, prerequisites that are considered central for analysing the shared context of the student and the teacher are 'meaningful experience' and 'disturbance' and 'interruption'. The chapter analyses and discusses these selected

prerequisites in order to offer a more nuanced picture of the interaction between students and teachers in a shared context.

Chapter 3, 'On learning (how) to learn', by Oliver Kauffmann, Merete Wiberg and Christopher Winch, deals with the concept 'learning (how) to learn'. The idea of the chapter is to develop arguments for a more fruitful conception of 'learning to learn' and to discard the problematic view that 'learning to learn' refers to a prime mover for learning and therefore can be viewed as an efficient means of learning. It is argued that 'learning (how) to learn' is a metaperspective on learning and not a reference to a specific competence or essence in human beings. Instead, it is argued that 'learning to learn' is a meaningful concept if it is understood with the background of a number of conscious, reflective acts, which enable the person to further develop concrete abilities, such as literacy and numeracy. Furthermore, the advancement of such reflective capacities is intimately related to bringing virtuous capacities and formation of the person to life on both an individual and a social setting. In this sense, learning to learn might be seen as a means for developing already-experienced processes of learning and as an aim with respect to living a good life.

In Chapter 4, 'Practical emotions in processes of learning', Søren Engelsen argues that emotions are of vital importance to learning processes. In the chapter, he deals with how emotions influence the learning processes of the teacher as well as the student. Engelsen analyses students' experiences of intrinsic motivation and meaningfulness and addresses the role of the teacher's own emotions in being sensitive to such experiences. By applying basic points in philosophical and psychological theories of emotion to a phenomenological investigation of value experience, the chapter investigates the significance of the way emotions function and dysfunction to processes of teaching and learning. From an aims and means perspective, certain emotions are seen as important means for learning, but at the same time, they can also be argued to be aims in their own right.

Chapter 5, 'Motivation, learning, and the educational dialogue' by Klaus Nielsen, takes as its starting point the motivational crisis and the growing experience of boredom as a problem related to the arrangement of the educational system. The chapter suggests that the learning objective paradigm introduces a way to conceptualise student participation, student intentionality and student agency that replaces the humanistic psychological and Piagetian theoretical framework with a behaviourist framework especially inspired by Skinnerian thinking. It argues that with a reintroduction of Skinnerian behaviourism through the learning objective paradigm, the educational system might run into the same problems that Skinner's work ran into five decades ago, namely a conceptually underdeveloped understanding of student intentionality and student agency, leading to a growing sense of boredom and lack of motivation among students.

In Chapter 6, 'Learning objectives as frameworks and resources in upper secondary education', with Luhmann's second generation systems theory as a theoretical framework and based on a literature review and empirical studies in three upper secondary schools, Ane Qvortrup and Hanne Fie Rasmussen investigate how

learning objectives are realised within upper secondary education, how teachers and students experience and respond to them and how these experiences contribute to their expectations of and participation in teaching. The chapter draws a picture of learning objectives as engaged in complicated conversation. Learning objectives are used by teachers in an ongoing mediation of the communication with students to set direction, to stay focused and to keep on track. This is done, for instance, by accentuating sudden aspects of learning, such as needs or prerequisites, and by evaluating student success. Furthermore, the objectives are used in the teachers' re-didactisation to support didactical choices in teaching and to reduce uncertainties. The objectives often refer to the national curricula, but also the tradition of the subject and teachers' values and beliefs play an important role. Altogether, the chapter draws a picture of learning objectives as engaged in complicated conversation, where they mediate as and between the aims and means of education.

In Chapter 7, 'The didactics of group work: Between means and aims in theory and practice', Gerd Christensen discusses aims and means of group work as a teaching and learning method. In Denmark, group work has been implemented at all levels of education since the 1970s, from primary school to university, but also in training sessions in organisations. The discussion in this paper takes its point of departure as pedagogical textbook introductions, where group work is often presented as a means to learning social skills and co-workability. However, as most students and teachers know, this is not always the case. Observations of long-term group work show that this can be a tough experience for the students. Contrary to expectations, the group work seemed to foster anti-social behaviour and development of selfish skills. The paper therefore concludes by suggesting how the (often) laissez-faire group pedagogy, which is dominant in Denmark, could be improved. The suggestions focus on alignment of the aims and means of group pedagogy.

Chapter 8, 'Formative reformulations in interventions on school development: A longitudinal case study of a project on student note-writing' by Torben Spanget Christensen, deals with an intervention project aiming to investigate and eventually change student note-writing at an upper secondary school. Inspired by Engeström's idea of 'activity systems', the teachers in the project are analysed as collective subjects acting within and between activity systems striving to develop and produce a meaningful object for change. The most important activity systems are the various school subjects that the teachers represent. The content of the object to be developed is student note-writing which is seen as a means for learning as well as an aim, due to being a tool for developing the students' disciplinary learning in combination with development of selfhood. The focus is on teachers' understanding of students' notes and subsequently their way of dealing with them in their teaching practice. This chapter also includes views from the student concerning how they learn from note-writing and analyses of how note-writing on an online platform initiate new ways of communication between students and teachers.

Chapter 9, 'A Luhmann-inspired approach to include neuroscientific knowledge concerning adolescents' motivation for learning in high school instruction', by

Nadja Marie Mariager, presents a theoretical framework for including insights about brain maturation and correlations with motivation for learning in adolescence, in teachers' planning and execution of instruction in upper secondary education. The chapter suggests that understanding the fundamental principles behind brain development in adolescence has the potential to improve understanding of students' prerequisites for learning, as well as understanding of the impact of classroom instruction on the brain's development, and thus on the student's prerequisites for further learning. More specifically, findings support psychological motivation theories and empirical educational studies that stress the importance of social cognitive as well as social-emotional abilities in a learning context. In this way, the chapter suggests that neuroscientific knowledge may help teachers to select existing learning theories that seem to be more effective than others. Furthermore, the findings have the potential to point out new normative guidelines for teaching, as there is some evidence that brain regions that support social-emotional functions are less active whenever the individual is performing task-required cognitive functions.

In Chapter 10, 'Patterns of Participation: A participatory account of learning to teach', Jeppe Skott takes a situative and socio-cultural perspective on learning to teach. Drawing on social practice theory and symbolic interactionism, he introduces a participatory framework called Patterns of Participation (PoP), which aims to understand (1) teachers' contributions to the interactions that emerge at their schools and in their classrooms, and (2) their experiences of being, becoming, and belonging as they relate to such interactions. The framework can be used to investigate the reflexive relationships between novice teachers' shifting professional identities, their changing positions among their colleagues and at the school in general, and their contributions to emerging classroom practices.

It is a pleasure for us to be able to present the work of these researchers in this second book from the network 'On the Definition of Learning'. We wish to thank all the authors for their very interesting, strong and groundbreaking work presented in this book, and for their contribution to the network in general. Furthermore, on behalf of several of our contributors, we would like to thank the reviewers for their effort. Work like this is what propels us to continue our work in the field.

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2. PREREQUISITES OF LEARNING FROM VARIOUS MEANS AND AIM PERSPECTIVES

INTRODUCTION

In the previous chapter, we suggested that in institutionalised processes of learning we are dealing with a multiple aim/means structure. Means and aims actualise themselves in concrete practices and can be viewed from a teacher as well as a student perspective. If we delve into this means and aim perspective, trying to tackle the phenomenon of learning, we might sketch out a picture of learning as something that happens because of a means or an aim, such as an instruction given by a teacher or an aim that is explained to the students. This would only be a half-truth. Most teachers know that they must be aware of a variety of prerequisites, which influence how students perceive the means as well as the aim intended and demonstrated by the teacher. Prerequisites for learning can be seen from a broader perspective as conditions, such as socio-economic factors, student mood, interior, culture, etc., which influence how teachers and students deal with learning and teaching. As argued in Chapter 1, in order to understand the complexity of the relationship between learning and teaching, we must avoid simple cause/effect explanations of how learning is brought about. Therefore, we do not understand prerequisites as the cause of learning, but as conditions and important aspects of learning. For example, 'meaningful experience' or 'persistence ability' are aspects of learning, but neither of these are simple causes of learning. In this chapter, we divide prerequisites into three categories; The first category encompasses prerequisites attached to the 'child/student'. Such prerequisites can also be conceptualised as the learning conditions of the child/student. One can identify many such prerequisites, but in this chapter we focus on 'meaningfulness' and 'persistence'. Other important prerequisites, such as personal intelligence or physical and mental disability, are beyond the scope of this book. The second category encompasses prerequisites attached to 'the teacher'. Here we are dealing with conditions of the teacher and important aspects are 'teacher's view on learning and 'teacher's reflection and listening'. The third category gathers conditions of 'the shared context'. Prerequisites that we consider central for analysing the shared context of the student and the teacher are 'meaningful experience' and 'disturbance' and 'interruption'.

THE CATEGORIES: THE STUDENT/CHILD, THE 'TEACHER'
AND THE SHARED CONTEXT

We focus on the categories 'child/student' and 'the teacher' in order to view means and aims from the perspective of the student as well as the teacher. At the same time, we need to focus on the shared context of the teacher and the student and therefore 'the shared context' is the third category. It is in the shared context that the student and the teacher experience and act. In the shared context, the child, as well as the teacher, 'undergo' the consequences of the environment. Also in the shared context, the teacher and the student actively strive from each of their own perspectives to realise their own ideas and projects. The conceptualisation of experience, in terms of a combination of passive undergoing and active trying and experimenting, is taken from the educational philosophy of John Dewey (1985: 146). According to Dewey, experience turns into learning when the combination of 'passive undergoing' and 'active trying' is loaded with significance (Dewey, 1985: 146). Dewey's understanding of the relationship between experience and learning is a point of departure for understanding the context. In the previous chapter, we argued that aims and targets function as support for the teacher as well as the students. In parallel to this, one can say that the context of the teacher and student supports and/or disturbs the teacher-student relationship. We suggest that these ideas of support and disturbance or interruption are important aspects of learning. Actually they are inherent in the concept of learning, since learning is driven by disturbance or interruption. We explore the categories above in selected theories of learning, which cover a spectrum of individual and socially-oriented conceptualisations of learning. Furthermore, we discuss and illuminate the selected theories of learning with reference to didactical theories and empirical research. The guiding question in the chapter is how these obviously categories, 'student/child, 'the teacher' and 'the shared context', might be viewed as prerequisites for learning and how they are to be understood with respect to means as well as aims.

THE CHILD/STUDENT CATEGORY

If we look at education on a micro-level, the child or the student is the reason for dealing with learning in institutional settings. Looking at the student, one can identify a number of prerequisites for learning. We have chosen two points of focus: meaningfulness and persistence. We will start with meaningfulness.

Meaningfulness as a Prerequisite for Learning

Carl Rogers, one of the founders of the humanistic approach to psychology, advocates the idea of meaningfulness as a prerequisite for learning. Rogers uses the term 'significant learning' to coin meaningfulness in processes of learning. According to Rogers, significant learning includes the experience of freedom,

autonomy, self-actualisation, self-directed learning, self-discovery learning and experimental learning (Rogers, 1969:157–165). Rogers focuses on the human self and the personal intentional striving of a person. Rogers' fundamental premise is that only significant learning changes and transforms the self and therefore significant learning should be preferred, rather than what Rogers describes as 'the nonsense syllable type' (1969: 5). In this sense, Rogers is critical towards defining learning as a bare change of behaviour in terms of, for example, achieved skills and competences. Whether Rogers is right depends on what kind of criterion we use for defining something as learning. Rogers' understanding of learning is inspired by existential philosophy, such as the philosophy of Søren Kierkegaard, who deals with how and why a human self develops (Rogers, 1969: 151), but we may ask whether personal existential change is too much to ask for in every learning situation.

We will argue that learning concerns personal change, but we need to differentiate between various levels of personal change. For example, it might change a student's attitude to life to grasp a subject in a new way. It means that to come to an understanding of, for example, historical events might change the perspective of a person. Furthermore, achieving competences, such as mathematical problem solving or bricklaying, might add something to personal development in terms of being a person in the world who can master this or that. Therefore, we will argue that Rogers is right in combining learning with meaningfulness of the individual. But we must be aware that to achieve new skills and competences, which from the perspective of the child in the first place did not seem meaningful or relevant, in the long run might perhaps add meaningfulness to the life of the student. If we view meaningfulness in terms of initiation into a culture, we must understand meaningfulness not just from the perspective of the individual, but also from the culture. 'Meaningfulness' might be seen as an 'empty' concept, but in this context, inspired by Rogers, it means focus on the human self, that a prerequisite for learning is a personal intentional striving towards something meaningful – it might be in the short-term or long-term. Seen from the perspective of the teacher, according to Rogers, significant learning requires a personal relationship between the student and the teacher (Rogers, 1969:106). Also, in the educational thinking of John Dewey, significance, as mentioned earlier, is a prerequisite for learning.

In other theories of learning, meaningfulness can be identified as a prerequisite in various ways. If we understand learning as adaptation to the environment, like for example Piaget and Bateson (Piaget, 1954; Bateson, 1999), meaningfulness is understood as a state of equilibrium. In Rogers' approach to learning, meaningfulness is related to a personal feeling of meaningfulness. And from Lave and Wenger's socio-cultural view of learning, meaningfulness relates to the ability to participate in a community in a meaningful way (Lave & Wenger, 1991).

In the next paragraph, we will focus on how persistence as a kind of personal striving is essential in the development and formation of character.

Persistence as a Prerequisite for Learning

During recent years, the idea of persistence as a prerequisite for learning has captured attention. Persistence and, in continuation thereof, the amount of learning time, is significantly and positively related to reduction in dropout rates (Renaud-Dubé, Guay, Talbot, Taylor, & Koestner, 2015), to students' achievement (Huang, 2015; Meyer, 2005), to students' coping experience (Frederici, Caspersen, & Wendelborg, 2016) and to student expectations for education (Weihua & Wolters, 2014). In the context of persistence as a prerequisite for learning, we take a primary interest in the two last-mentioned aspects, which most directly take the perspective of the student and relates to persistence as a kind of personal striving that is essential in the development and formation of character. One may argue that these aspects to some degree replace the psychological concept of intrinsic motivation that has taken up a lot of attention over a period of years since the nineties. Persistence refers to the ability to be motivated (Larson, 2000) and is about students' behaviour when encountering difficult tasks and about to what degree students give priority to schoolwork (Frederici, Caspersen, & Wendelborg, 2016:4). It is related to such things as engagement (Green et al., 2006; Patrick, Kaplan, & Ryan, 2011), effort (Goodenow & Grady, 1993), autonomous academic initiative and action (Danielsen, Wiium, Wilhelmsen, & Wold, 2010; Larson, 2000), resilience (Henderson & Milstein, 2003) and self-regulation (Black & Wiliam, 1998a, b).

A fundamental idea behind the concept is that learning is self-learning, which must relate positively to school-related factors (Danielsen, Wiium, Wilhelmsen, & Wold, 2010) and the purpose or aims of education. In that regard, it is a concept that does not erase or level the duality between teaching and learning, but insists on keeping this dualism alive. Furthermore, it is a fundamental idea behind the concept that in a rapidly changing world, it may be particularly important to stimulate students' self-determination and their capacity for autonomous action factors (Danielsen, Wiium, Wilhelmsen, & Wold, 2010). Based on this, it can be argued that it might replace – or is a specific ability that might satisfy (a part of) – the concept of 'learning to learn', which in itself is vacuous if taken to mean that we need to acquire a capacity to learn, since we necessarily have this if we are to learn anything (Winch, 2008). 'Learning (how) to learn' is discussed by Kauffmann, Wiberg and Winch in Chapter 3 of this book.

TEACHER CATEGORY

Teachers have a major influence on student experience and classroom practice. Their influence is formed by such things as expertise, proficiency and knowledge about subjects, about pedagogical approaches and about student learning – that is, one may say, the explicit resources that teachers bring (Kelly, Hochmann, Pratt, & Dorf, 2013). Furthermore, as Kelly, Hochmann, Pratt and Dorf (2013) noticed, it is formed by less explicit resources, such as teachers' philosophies, values and

disciplinary understandings (Shulman, 1986, 1987; Summers, 1994; Osborne & Simon, 1996; Harlen, 1997; Marshall, 2000; Turner-Bissett, 2001). To this, one may add, for example, teachers' habits of teaching (Hoban, 2002; Lindhart, 2007; Skott, 2001, 2009; Lortie, 1975), resources provided by the school and classroom, i.e. whether the latter lends itself to individual or collaborative group work (Troelsen, 2016), the pressures from particular interested parties, such as parents, students, colleagues, school inspectors, etc. (Kelly, Hochmann, Pratt, & Dorf, 2013), and the like. There is good reason to identify and illuminate the prerequisites for learning from the perspective of the teachers, and there are a lot of aspects to deal with. At present, we have chosen to point out the dynamics between the teachers' view of learning and how teachers' reflect on their view of learning by listening to the students.

From the Teachers' View of Learning to Reflection as a Prerequisite for Teachers' Learning

Teachers' understanding and interpretation of learning play a fundamental role in the teachers' choices when teaching (Fang, 1996; Prawat, 1992). Such understandings and interpretations put some parts of learning and the entire educational situation in the foreground and inevitably push other parts into the background (Walker & Soltis, 1997: 33). Teachers' understanding and interpretation of learning is shaped by personal attributes, including values, goals, skills and abilities (Deemer, 2004), but also learning taxonomies seem to have an influence. Learning taxonomies classify learning into systematic hierarchies of objectives and thereby describe ways that teachers might think about and promote learning as they guide students through learning processes (Muehleck, Smith, & Allen, 2014; Harðarson, 2013). As Schiro (2008: 9) puts it, they function as magnets that tug on teachers, pulling them in certain directions. In the article "Relations between Teachers' Classroom Goals and Values", Pudelko and Boon (2014) demonstrate how learning goals and values are potentially key drivers of teachers' pedagogy. Teachers make pedagogical choices according to the values and goals they aim to develop in students (Ames & Ames, 1984; Holland & Verplanken, 2002), teachers communicate what counts as achievement through expectations and rewards (McClelland, Atkinson, Clark, & Lowell, 1976) and teachers thereby impart values and goals on students (Ames, 1992; Wigfield, Eccles, Schiefele, Roeser, & Davis-Kean, 2006; Martin & Dowson, 2009; Wentzel, Baker, & Russell, 2012).

Teachers' way of teaching might be related to their view on learning. But on the other hand, their habits of teaching might not be informed or changed by this view and knowledge of learning. Therefore, in order to address how teachers eventually change their view of learning, we must deal with how teachers reflect on learning and eventually learn from their practice. An interesting means to help teachers reflect on their own teaching is to listen to the students' experience. In the following, we will firstly refer to Hoban's studies, where he suggests that listening to student

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interviews could be a catalyst for teacher reflection. Secondly, we will address English's theoretical discussion of listening as an educational category.

Gary Hoban did a study of high school teachers, which involves teachers listening to audiotaped interviews of students' experiences of their teaching. The interviews were conducted by the researcher:

> Listening to the student tapes in this study informed the teachers that here are multiple perspectives on classroom practices, which David and Craig [The teachers (ed.)] were not aware of before the programme started, as they taught students in their classes in the same way. If teachers seriously consider a variety of student views on class experiences, they may realise that teaching is more than a simplistic delivery of knowledge and that there may be a range of interpretations from students, based on their social and cultural stories. (Hoban, 2000: 144)

The result of the study was that listening to the students' experiences changes the teachers' understanding of their practice. This study is interesting because it addresses how to bring about teacher learning and reflection outside the context of the classroom. Because the students are free to tell their experiences of the teaching, it might bring to light something else than the teacher would have the opportunity to discover in the context together with the students. In this sense, it is different than for example Donald Schön's studies of practitioners' reflection in practice (Schön, 1987), where reflection is strongly connected to the context.

Based on Hoban's studies, 'listening' can be seen as a pedagogical and didactical category. This is in line with the view of Andrea English. She deals with listening in terms of 'educative listening'. She draws on Herbart's concept of 'tact' and understands listening as an educative means of the teacher as well as the student. The concept of 'tact' can be understood as orchestration in the classroom. The teacher needs to listen to the students in order to understand what they are struggling with, and the students must listen to the teacher in order to establish a dialogue. English describes educative listening in the following way:

> The teacher's listening is educative when the teacher is engaged in listening for signs that a productive struggle is taking place in the learners' experiences, and simultaneously, for ways to support learners' transformation of this struggle into aspects of reflective learning processes. (English, 2014:134)

Listening is only one aspect of teacher reflection and learning, but as it appears, it is fundamental for teachers' understanding, receptivity and ability to respond to the students.

THE SHARED CONTEXT CATEGORY

'Context' is a central concept in various theories of learning, such as situated learning (Lave & Wenger, 1991), social cultural theories of learning (Vygotsky, 1978)

and pragmatic theories of learning (Dewey, 1985). The concept of context in these theories points out that learning is not only something that goes on 'in' the individual, but is always also a social and distributed phenomenon. The concept of 'situation', which is central in all the theories mentioned above, refers to learning as a phenomenon that happens somewhere between individuals. In the following, we focus on meaningful experience and disturbance/interruption as important aspects of learning in a shared context.

Meaningful Experience as a Prerequisite for Learning

In *Democracy and Education*, John Dewey suggests a conceptual framework for understanding the phenomenon of learning. This conceptual framework has its outset in an analysis of what kind of structure of experience might lead to learning. The analysis is not based on systematic empirical studies, but could be characterised as a phenomenological analysis of human experience. Dewey's suggestion is that learning requires a reflective structure of experience that combines passive and active elements with meaningfulness, in terms of understanding the consequences of an action. Dewey describes the active and passive dimensions as 'trying' or 'action' and 'undergoing' respectively. When the individual acts, they undergo the consequences of the action. If learning is about to happen, the result of the process must be experience of significance or meaning, in terms of understanding how actions and consequences of actions are linked together:

> When an activity is continued into the undergoing of consequences, when the change made by action is reflected back into a change made in us, the mere flux is reflected back into a change made in us, the mere flux is loaded with significance. We learn something. (Dewey, 1916/1985:146)

The very structure of experience is decisive for learning, according to Dewey. Dewey's description of how experience turns into learning has some affinities with, for example, how Gadamer conceptualises the concept of 'understanding' in his hermeneutical philosophy. According to Gadamer, understanding is a dialectical movement between individual projections and the things themselves. Understanding is a back and forth movement between individual projections and striking back from the 'things themselves':

> A person who is trying to understand is exposed to distraction from fore-meanings that are not borne out by the things themselves. Working out appropriate projections, anticipatory in nature to be confirmed "by the things" themselves, is the constant task of understanding. (Gadamer, 2013:280)

It is relevant to compare Dewey's concept of learning and Gadamer's concept of understanding, because learning can be seen as an ongoing and circular process of understanding. This can be illustrated by the child's ongoing explorative approach to the world, in order to get a full picture. According to Dewey as well as Gadamer,

this quest for meaningfulness is a condition for human beings, and experience of significance and coming to understanding are essential signposts in the life of human beings. Gadamer uses the concept of 'horizon' or "To have a horizon" (Gadamer, 2013:313) as a way to describe how experience of meaningfulness is embedded in a context. In order to understand, we should be aware of the interplay between an individual who experiences and tries to cope with what is going on in a given context, on the one hand, and the context which strikes back with consequences that the individual undergoes, on the other hand.

Looking at this structure, the concepts of 'cause' and 'effect' would not be suitable for analysing what is happening. A means and aim structure might be more helpful. If we assume that the aim is to bring about learning, the means for learning is the very complex structure of experience. Nobody would ever be able to understand or experience another person's experience. But in educational contexts, it is essential to be aware of the very complex flux of experience, which takes place in the interaction between and amongst the individuals in the situation.

Disturbance and Interruption as Prerequisites for Learning

Because change is essential for understanding the phenomenon of learning, most theories of learning describe triggers of change. Some theories of learning describe triggers of change with concepts such as disturbance, interruption, uncertainty or lack of balance. If we look at learning from the perspective that learning happens because of a problematic situation, something which must be coped with, we might understand learning in terms of a striving for balance. Piaget and Bateson, both inspired by biology, would explain learning as a question of adaptation.

If we look at learning from a means and aim perspective, we can understand phenomena such as disturbance and interruption as means for learning. Andrea English addresses interruption as a means for learning for the teacher as well as for the learner. "On this account, when teachers are engaged in educative listening, they are particularly attuned to interruptions in their own experience that can be indications of interruptions in the learner's experience (English, 2014:134). In the shared context, teaching and learning happen as a result of an interplay between the persons in the context. The role of the teacher is to help the student to learn, while the role of the student is to be subject to change. In the shared context, the agents disturb each other in various ways. Teaching might be seen as organised disturbance and interruption, while learning might be the result of disturbance and interruption from the teacher and the other students. Disturbance and interruption might be seen as being productive for reflective learning.

CONCLUSION

The guiding question in the chapter is how the categories 'student/child', 'the teacher' and 'the shared context' might be viewed as prerequisites for learning and how they

are to be understood with respect to means as well as aims. The categories we have pointed out cover the various perspectives from which processes of learning must be seen. If we go deeper into what might be seen as prerequisites, if viewed from these categories, we understand that the event of learning in an educational context requires (1) meaningfulness, which in the short-term or long-term helps the student to understand the bigger picture of life, (2) the student's ability to persist in order to keep going on, with what hopefully might turn into something meaningful, (3) teachers' understanding and reflection on learning by listening to the students, (4) meaningfulness experience in a shared context, which combines active as well as passive learning and becomes significant, and (5) triggers of change such as disturbance and disruption.

Looking at these prerequisites, we might discuss how to extract or distinguish clearly between means and aims. Our conclusion is that we cannot make a sharp distinction, because means and aims are intertwined in processes of learning. In order to bring about learning, the teacher must support meaningfulness in the situation, but at the same time meaningfulness is an aim for human beings in general. Disturbance and disruption do not initially appear as aims for learning, but it turns out that they are necessary ingredients for change, and change is an aim for learning. Reflection is a means, but it is also an aim that teachers and students learn to become reflective human beings. All of the prerequisites we have sketched out in this chapter might be problematic if the content of learning is problematic. For example, the ability of persistence is problematic, if for example the student is about to learn something that should be rejected from a moral standpoint. The same applies to meaningfulness. What we have addressed in this chapter is the phenomenon of learning, and to a certain extent, learning is blind when it comes to whether the content of learning is good or bad. It does not mean that values do not play an important role in learning, but that learning in itself is not a moral concept.

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3. ON LEARNING (HOW) TO LEARN

INTRODUCTION

'Learning how to learn' is a mantra which is often advanced by politicians and administrators. From an administrative and educational-organisational perspective, it would be very convenient if learning was something which students could learn. If it were possible to train a general ability to learn, it would make the learning of specific subjects much more controllable and therefore more efficient. But the fact is that it is far from easy to gain any clear picture about what learning (how) to learn really means – and it is probably also wrong to understand the concept as a first mover of learning which reveals the secret essence of learning.

If it were possible for a person to answer 'yes' to the question: 'Have you learned to learn?' what might the answer be if you continued your question and asked: 'and how would you describe how you learned to learn?'

'Learning to learn' is a problematic concept for several reasons. First we briefly recapitulate what we take to be serious problems with this concept, problems which have been pointed out already (see e.g. Winch, 2008). However, instead of adding more critical points following the direction already indicated, we develop arguments for a more fruitful concept of 'learning to learn' along two different paths. These arguments are presented in sections 3 and 4. In section 5 we extend our critical stance towards the concept of 'learning to learn' into a more positive account by pointing out a number of concrete abilities and capacities on which 'learning how to learn' relies, such as literacy and numeracy, which can only be understood and brought into play function against the background of the reflective capacities of the person concerned. We emphasise, however, that the flourishing of such capacities and abilities also critically depends on the development of personal traits and virtues as well as social ('civic') virtues. Section 6 deals with this issue.

Here are two main lines of argumentation for a useful concept of 'learning to learn' in a condensed form:

1. 'Learning to learn' lends a potentially fruitful meta-perspective on learning, a stance from which we can reflect on the limits and potentials of first-order processes of learning, including learning taking place at a non-conscious mental level, i.e. without any conscious effort from the subject. In this sense *learning* is understood here as the task of learning, rather than the achievement of something which is

learned. In addition, the literature on second-order mentality such as the 'desire to desire' (e.g. Frankfurt, 2003) and the 'thought of thought' (e.g. Rosenthal, 2005) may constitute an interesting path with respect to the investigation of 'learning (how) to learn'.

2. Secondly, whereas it probably does not make much sense to understand 'learning' from a general perspective, e.g. as a discourse of 'effective learning' (and the complicated, not clearly understood interplay between conscious and non-conscious processes of learning adds to this picture), we argue that 'learning to learn' indeed makes sense as a discourse on how to achieve valuable lives on an individual and a communal level (see also Göhlich & Zirfas, 2007). In other words, questions about 'learning how to learn' aren't seen from the perspective of students becoming more effective learners. Instead, the question is how we are to identify general learning abilities which can help individuals to achieve a valuable life for themselves and for society in general.

'LEARNING TO LEARN': A PROBLEMATIC CONCEPT

'Learning to learn' is a problematic concept for several (well known) reasons. For one thing, it gives the illusion that such a general ability to learn exists. Furthermore, it gives the impression that learning is a formal and general ability which can be separated from concrete learning. 'Learning to learn' is used as a slogan by policymakers who argue (in the name of democracy and inclusion) that if schools and educational institutions train children and students in the ability to learn, it will help them obtain opportunities in society and contribute to the creation of a fairer society. Inspired by the ideas of Hattie, four municipalities in Denmark have launched a project entitled 'Alle elever skal lære at lære mere' [All students should learn to learn more]. On the other hand, learning to learn in a lifelong learning perspective is also used in the name of efficiency, the aim being to create efficient and flexible workers for society.

Michael Young (2015) has also pointed out that 'learning' is not a generic phenomenon – hence 'learning to learn' is problematic or makes no sense if it means that learning is independent of what is learned.

In Winch (2008) another analysis of the concept 'learning to learn' is presented. The main point here is that 'learning how to learn' is a superfluous concept because if the only way to achieve an ability is to learn something, there is no use for this special ability called 'learning how to learn' because you must already have the capacity for learning before you can learn anything. Therefore learning to learn doesn't make sense unless it refers to the acquired ability to learn something specific. The only way you can gain an acquired ability is by learning something specific. Hence, Winch's conclusion is that 'there is no general ability to learn how to learn' (2008: 663). Learning to learn is not a prerequisite for learning. Learning to learn, seen from a philosophical perspective, should instead be seen as a set of strategies for dealing with and enhancing concrete abilities, such as (for instance) reading or bricklaying.

In this sense, 'learning (how) to learn' provides a meta-perspective on learning and is not a reference to a specific competence or essential human trait.

Winch's main argument against 'learning how to learn' is that this concept doesn't add anything to various abilities such as reading and numeracy. The overall problem of the concept of 'learning to learn', which is also pointed out by Göhlich and Zirfas, is that 'learning to learn' is a circular statement or vicious circle (circulus vitiosus). To learn (how) to learn implies that you have already learned.

Göhlich and Zirfas argue that learning to learn (lernen-lernen) as a generalised capacity to learn ('Generalisering der Lernfähigkeit') deserves some attention and that 'learning to learn' in this sense has been discussed since Antiquity but especially in the Enlightenment due to the process of modernisation.

According to Göhlich and Zirfas (2007: 191), Wilhelm von Humboldt also pointed to the generalised capacity to learn. They argue that the increased emphasis on 'learning to learn' today is a symptom of an uncertain world/situation (Göhlich & Zirfas, 2007:192). On the one hand they acknowledge the concept of 'learning to learn', but on the other hand they do worry about its use. According to them, it is problematic if the exploration and development of the idea of learning are 'swallowed' in processes of modernisation instead of being understood as being under the influence of these processes.

Even so, 'learning (how) to learn' might be a useful concept when it is understood as a meta-perspective on (first-order) learning processes. Notice in particular that even if 'learning (how) to learn' implies that learning has already taken place, it is still possible that *something else* can be learned from the specific process of second-order learning (on how to learn). If this is the case, there is no vicious circle involved. Learning at a first-order level sometimes takes place without the contribution of conscious awareness (see in particular the seminal work by Reber, 1992). With this in mind, 'learning (how) to learn' illustrates a *general*, theoretical, reflective meta-perspective on first-order learning processes from which their specific properties – in contrast with the properties of the processes of which the learning subject is consciously aware – can be highlighted. Secondly, another possible but more daring suggestion along this line is that a subset of the *concrete* first-order processes of learning actually becomes conscious when reflected on by the learning subject (along the lines of reductive higher-order theories of consciousness which have been discussed extensively in the philosophy of mind, see e.g. Rosenthal, 2005). According to the higher-order theory of consciousness, a mental state M1 in a subject S amounts to no more or less than S simultaneously having another mental state (M2) of a specific type about being in M1. M2 is a thought about being in the state M1, whatever type of mental state this might be. This thought (about being in M1), however, does not need to be a conscious state itself. For example, a pupil who is in a state of desire for playtime can be characterised as having a *conscious* desire for playtime if (and only if) he simultaneously also has a concomitant thought of being in this state of desire (without the thought of having the desire *itself* necessarily being) (cf. Rosenthal, 2005). Thus, if 'S' reflecting on x' sometimes implies that

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S has the capacity for learning (more) about x, this opens up the possibility of reflection, with 'S learning how to learn' making non-conscious learning processes conscious for S in a learning task which targets these very first-order processes. This assumption lends a more dramatic sense to the expression in which 'learning (how) to learn' and suggests new paths for empirical investigation.

In the next section we briefly fill in some details about the first of these two potentially fruitful perspectives on 'learning how to learn'.

THE PROBLEMATIC A PRIORI CONCEPT OF CONSCIOUS LEARNING

The presence of conscious awareness no doubt plays a central role for cognition and behaviour, although the issue of the causal roles of consciousness is highly controversial (see e.g. Block, 1995; Rosenthal, 2008). Through the conscious apprehension of objects, events and situations, possibilities for cognitive and bodily actions become available which differ with respect to a number of features from the more automatised behaviour and in various respects limited scope of cognition that we exhibit when we are merely aware of elements in the world in a non-conscious way (see e.g. Lahav, 1993; French & Cleeremans, 2002). Today there is a large body of empirical evidence for the existence of non-conscious mental processes, achieved in particular in clinical and experimental (neuro)psychology (de Gelder, de Haan, & Heywood, 2001; Weiskrantz, 1997). One might accordingly expect that the difference between conscious awareness and non-conscious awareness would be a relevant and important issue in the efforts to understand the various forms and mechanisms of learning and education. This is clearly not the case, however. Conscious awareness *itself* is rarely explicitly addressed in disciplines dealing with questions about the education and learning of experiencing individuals, and the same thing is true of the duality between non-conscious awareness and conscious awareness. Even if we allow that certain mental phenomena exist, non-conscious *learning* does not have the prominent role it deserves in learning theory. Non-conscious learning does not mean that the learning subject isn't conscious as a subject (i.e. in a state of coma or sound asleep). It refers to situations in which subjects who are fully awake learn without being aware of what they are learning. Thus the dichotomy between conscious and non-conscious learning is a dichotomy between situations in which the learning subjects are aware of what they are learning and situations, where they are not aware of what they are learning. The dividing line is not always sharp here. Thus, our claim is not that *all* instances of being aware of something fall precisely on either side of the line dividing conscious and non-conscious instances of mental processes. This boundary is perhaps fuzzy. There are cases of 'fringe consciousness', peripheral vision, tip-of-the-tongue phenomena, and many others, which are not easily treated as instances of either being consciously aware of something (in a thematic sense) or merely being aware of something. These complicated issues are not in our focus here.

Our point here is simply that by implicitly ignoring non-conscious instances of learning, conscious learning is often *treated* as if it was the default mode of learning.

This is of course not the same as downright *denying* the existence of non-conscious learning, but it might give a distorted view on learning processes. Illeris (2007) acknowledges the existence of non-conscious learning, and this may be a useful example to consider here. He recognises that research in learning has focused predominantly on conscious learning. But despite Illeris' acknowledgement of the fact that non-conscious processes relevant for learning take place, he deliberately avoids dealing with this issue 'as research on this is rather limited' (2007:19), as he explains. Despite this claim, it is not entirely true that the extent of the research into non-conscious learning is 'rather limited'. For instance, the well-defined research field denoted 'implicit learning' has been under steady development since the mid-sixties (Reber, 1992; Berry & Dienes, 1993; Reber, 1993; Shanks & St. John, 1994; Stadler & Frensch, 1998; Reber, Allen, & Reber, 1999).

Some of the results and methods of implicit learning are certainly disputed, but to deny that there is an established research field here would be mistaken. The problem is, however, that there is no clear connection between this experimental research field and the typically more mundane discussions of learning and theories of learning related to concrete educational and didactical questions.

Secondly (and more tellingly), without reflecting on the distinction itself, Illeris refers to conscious as well as non- and un-conscious aspects of the assimilative and accommodative dimensions of learning in his treatment of Sigmund Freud, Jean Piaget, David Kolb and other central figures in learning theory, leaving a number of ambiguities in his wake. In his 'learning triangle' (see Figure 1), different dominant
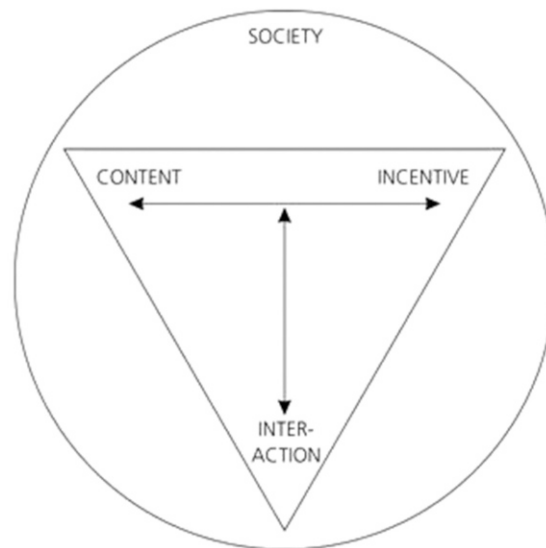

Figure 1. The three dimensions of learning (Illeris, 2007)

theoretical approaches to learning are plotted according to their relation to three main dimensions of learning: 'Content', 'Incentive' and 'Interaction', each of which forms a point in the triangle (Illeris, 2007).

In this triangle, it appears that there is an intimate, dynamic relation at the axis between the content and the incentive dimension. But notice that the conscious/non-conscious bifurcation is clearly orthogonal to this axis. Indeed, under 'content' Illeris lumps together 'knowledge', 'understanding' and 'skills' (Illeris, 2007:25). Skills are typically exercised without conscious awareness that they are being exercised, and knowledge can be exercised consciously as well as non-consciously. Similarly, with respect to the other end of this axis, we are told that the incentive dimension 'functions largely unconsciously' in assimilative learning, whereas in accommodative and transformative learning it 'is typically more conscious in nature' (2007:95). Thus, a conscious/non-conscious distinction is acknowledged, but it does not figure in the triangle and is not discussed as such. Notice that there is a question here as to whether or not the author interprets Piaget correctly.

This is only one example of a tendency in many discussions of learning: that learning processes predominantly and implicitly are understood as conscious processes – the learning individual is consciously aware of what is being learned. This is an *a priori* assumption about learning processes which is both natural and innocent. We do not deny, of course, that tacit dimensions of knowledge and learning processes have been acknowledged (e.g. in Polanyi, 1958, 1966; Schön, 1983; Dreyfus & Dreyfus, 1986). Our point here is that the emphasis on the conscious dimension of learning is absolutely dominant when it comes to considerations on learning from educational, didactical and teaching perspectives. It is a very natural assumption to make, taking all the politico-educational issues about evidence, effects, aims and didactical methods surrounding discussions about (institutionalised) learning into consideration. These aspects are handled, controlled and reflected upon – which certainly appears to demand the complicity of conscious thinking. Hattie's programme on 'visible learning' (Hattie, 2009) is no exception to this, with its emphasis on the importance of teaching that enhances pupils' ability for metacognitive and verbalisational tasks. The *a priori* assumption about conscious processes is also innocent in the sense that much learning certainly *appears* to take place in a conscious mind, meaning that I am aware of the object of learning. This is a standard 'property' of conscious processes: they appear to take everything into their domain and remain silent about what is not presented within the charmed circle of consciousness (cf. Dennett, 1991). In other words, we are not conscious of what we are not conscious of. We believe that the concept of 'learning (how) to learn' is helpful.

To learn (how) to learn means either to step back and reflect on the properties which characterise first-order processes of learning, or to develop virtues and habits that assist in further learning. Focusing on these factors may enable us to learn about them and come to a thorough understanding with respect to the vexed questions about which learning processes are 'deeply' unconscious (i.e. never available for

consciousness), the capacities of unconscious learning of various types of skills, and the interaction between non-conscious and conscious processes and so on and so forth. And *after* coming to a deeper understanding of these questions related to the 'twilight zone' between conscious and non-conscious mentality – *after* beginning to 'learn (how) to learn' – we might of course reevaluate our managerial-educational questions about means, aims, methods and effects. So in *this* sense (and probably only in this sense!), learning (how) to learn (more effectively) *can* be a first mover after all, provided that we acknowledge that it means building on capacities for learning which we have already acquired, some of which will have to be acquired in the early years of formal education (see section 4 below), and others through various kinds of non-formalised situations of everyday life and in non-formal and informal situations in the workplace.

LEARNING HOW TO LEARN IN TERMS OF ACQUIRING AND REFINING HABITS OF LEARNING

If the 'concept of learning (how) to learn' is referred to as habits of learning, as pointed out (for instance) by John Dewey with the equivalent 'learns to learn', it is possible to view 'learning (how) to learn' as a reflection on processes of learning that have already happened (Dewey, 1916/1985: 50). Following the argument advanced in the section above, reflection on unconscious as well as on conscious processes of learning might have an improving role for these processes, as well as for processes of learning in the future. For example when a musician practises a piece of music and finds out during the session that one method is better than another. Another example is a child in a 'learning to read' process who experiments with various methods that contribute to her understanding and deciphering of the meaning of a text. These examples indicate that 'learning to learn' is better understood as reflection on already acquired habits of learning, which might lead to better and hopefully more meaningful processes of learning because of breaks in and a refinement of habitual ways of living. In other words, it is all about learning to learn more effectively.

This indicates in turn that learning to learn is an outcome of reflection and refinement of what a student has already done. Consequently, according to this understanding 'learning to learn' refers to conscious awareness and consideration during or after a process in which the student (perhaps supported by a teacher) has been struggling with a problematic task or situation, such as learning to read, play or practise something.

If 'learning (how) to learn' is taken to mean reflecting on learning, which might lead to the transformation of a person and their habits, it is relevant to compare it to the concept of 'Bildung' and 'Allgemeine Bildung' (general formation). Allgemeine Bildung in the Bildung tradition refers to non-disciplinary experience, knowledge and reflective competences, such as judgment of moral and ethical issues, which have become incorporated in an individual and therefore function as acquired personal knowledge, ways of reflective thinking and skills, in the sense that they form an

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attitude and approach of the student. The concept of Bildung developed by Wilhelm von Humboldt focuses on the relationship between individual and world and how the mediation between individual and world in terms of an interplay between receptivity and self-activity might lead to a valuable life for humanity: "What man needs most, therefore, is simply an object that makes possible the interplay between his receptivity and his self-activity" (Humboldt, 2001:60). In a school setting, the concept of Bildung involves discussions of values such as freedom, self-determination, autonomy, responsibility, democracy and community. In this sense the concept of Bildung focuses on moral and ethical issues and the general question of how to lead a good life for the individual as well as for other human beings. The ability to discuss and reflect on these issues might be seen as a general capacity related to the development and formation of individual character. Since it refers to generalised knowledge and skill attained during the student's dealings with various disciplines, it contributes to the formative process of the student. 'Allgemeine Bildung' involves the development of virtues which (for example) enable the student to cooperate with other students and to participate in democratic processes. We will come back to the development of virtues as an important part of learning (how) to learn.

From a Deweyan and a 'Bildung' perspective, it is not possible to isolate general dimensions of learning because they will always be part of processes of experience in which something specific is learned, such as reading, riding a bicycle or solving a mathematical problem. Therefore it is only in a logical sense that we can isolate general dimensions of learning. With regard to developing the 'means' to support learning, it should be stressed that the phenomenon of learning in the task sense of this word involves actual processes of experience undergone by a person. The process of learning might be prepared (taught) and supported by a teacher, with knowledge and expertise of a disciplinary area or practice being necessary, but the person in the midst of learning must undergo and deal with the subject herself, directly or indirectly. According to Dewey, learning can be described as a flux which consists of a combined and entangled process of active experimental trying and passive undergoing that turns into learning if the experience is loaded with significance (Dewey, 1916/1985). In this sense, learning is personal but socially situated. Therefore, learning (how) to learn, if we follow Dewey's definition of learning, happens while dealing with specific subject matter. It might be of a theoretical or practical orientation.

CAPACITIES AND ABILITIES TO LEARN

What, then, are the capacities and abilities that enhance our ability to learn? The ability to learn effectively depends on the development of a certain degree of independence on the part of the learner. Such independence presupposes the powers of reflection on one's own learning described in the previous section, but it also depends on the acquisition of certain highly specific abilities: those that make it possible to attend to the tasks of learning without the aid of others.

Foremost among these abilities are those associated with literacy and numeracy. It is no accident that the acquisition of literacy and numeracy is among the principal aims of elementary schooling. Successful learning in secondary school depends, among other things, on acquiring the ability to engage in independent study and practice. It is noteworthy that in many developed countries the universal acquisition of literacy and numeracy in elementary school is still far from being achieved. One should add here that it is not merely the ability to read literal meaning or do arithmetic at an elementary computational level that is involved. Students also need to be able to re-organise, infer, evaluate and appreciate material that is presented to them, as well as acquiring the ability to develop strategies for searching for what they need to know (Beard, 1987). Likewise, the ability to use mathematical techniques effectively involves being able to correctly put a problem into a mathematical formulation that allows it to be solved.

There is evidence that these abilities are not always taught effectively, even though some success has been achieved with, for example, elementary computation and reading for literal meaning (see Polya, 1954 with regard to mathematics). Success in this area depends on teachers who are able to develop the pedagogical techniques necessary to enable students to work in groups on complex text-related tasks, and to discuss strategies for problem solution. These abilities in turn require the ability to take turns, to listen to others, to accept criticisms of one's views and to negotiate one's preferred solution. Such abilities are different from technical aids and require the development of powers of reflection on one's own learning ability described earlier in this chapter.

THE DEVELOPMENT OF VIRTUES RELATED TO LEARNING

We need finally to take into account the personal characteristics that are necessary for learning to be successful, that is, for the task of learning X to result in actually knowing or being able to do X. It is helpful to begin by making the point that learning is not always easy and that tasks may seem so frustrating that we give up or seek an easy but ineffective solution to a problem. Effective learning depends largely on the ability to overcome difficulties in learning, both individually and collectively. What can be said about this? It is obvious that overconfidence in one's abilities can lead to carelessness and faulty strategies. Likewise, too little success can lead to a lack of confidence and to discouragement, which leads to a fatal cycle of failure. It is evident that these two potential dangers for students should be avoided by teachers – but how?

There can be no easy or straightforward answer to this question. It is clear, however, that teachers at all levels of education need to be aware of these difficulties and to engender in their students attitudes that are neither over-confident nor under-confident. In particular, they need to be able to develop resilience in their students, virtues of patience, self-discipline and attendance to detail, which Kerschensteiner calls the 'bourgeois virtues' (Kerschensteiner, 1964). Similarly, those kinds of

learning which depend on the co-operation of others also need to be developed, which Kerschensteiner calls the 'civic virtues'. Kerschensteiner's ideas have been incorporated into contemporary German VET curricula, usually under the guise of 'personal and social competences' respectively. It may be that some possession of the bourgeois virtues is necessary to acquire these civic virtues, and teachers will need to think carefully about the opportunities that they provide for students for co-operative work and when they are ready to undertake it and to what degree. Without some possession of these bourgeois virtues it will be difficult to acquire the ability to learn effectively, either in school or in professional situations in adult life.

CONCLUSION

The concept of 'learning to learn' may refer to two different things. On the one hand it can be used by policymakers and administrators to refer to a capacity which (if developed) contributes to efficient processes of learning; and on the other it may be a concept which helps us to understand the means of learning from the perspective of the learner who is in the midst of learning, and from the perspective of the teacher who supports the students' reflections on processes of learning. We have argued that learning (how) to learn is a meaningful concept if (and only if) it is understood against the background of a number of conscious, reflective acts, enabling individuals to develop such concrete abilities as literacy and fluency. Furthermore, the advancement of such reflective capacities is intimately related to bringing virtuous capacities to life, benefiting both the individuals concerned and society as a whole.

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4. PRACTICAL EMOTIONS IN THE PROCESSES OF LEARNING

INTRODUCTION

Whether formalised in curricula or not, experiences of topics and practices being valuable and meaningful, understood in sufficiently broad terms, are of vital importance to learning processes, almost no matter what the specific content and context is. Arguably, such experiences are important in their own right (Engelsen, 2013, 2017 forthcoming; Tiberius, 2008) and thus as learning objectives in themselves, but moreover they are of central importance as a means to promoting intrinsic motivation that is vital in many processes of learning (Amabile, 1985).

With this background, the stimulation of such experiences in learners becomes central to teaching. In this chapter, I analyse how emotions fit into this picture from the point of view of the teacher as well as the student. I analyse students' experiences of intrinsic motivation and meaningfulness and I address the role of the teacher's own emotions in being sensitive to such student experiences. By applying basic points in philosophical and psychological theories of emotion to a phenomenological investigation of value experience, the chapter investigates the significance to processes of teaching and learning of the way emotions function and dysfunction.

I first present what I take to be a promising theory of emotions, explaining central ways in which emotions are often dysfunctional with respect to cognition, but also have important cognitive functions, in particular with regards to the apprehension of value (1). Emotional life is then taken into account in a student perspective. I investigate how students' emotional life can constitute experiences of meaningfulness as well as motivation. This makes certain emotions important means for learning, but at the same time, they can also be argued to be aims in their own right (2). Applying the theory of the relation between value experience and emotions to the study of intrinsic motivation and meaningfulness, without losing sight of the potentially cognition-distorting nature of emotions, I then argue that teachers' other-directed emotions can serve the function of becoming sensitive to students' intrinsic motivation and experiences of sense-making (3). The presented theory of emotional awareness lays the ground for concluding that emotional maturity is an important part of successful teaching, in the sense of having a well-developed aptitude for context-sensitive emotion regulation, together with a meta-cognitive awareness of one's emotional dispositions, and an awareness of the importance of facilitating certain types of emotional experiences that are crucial to students' motivation and meaning-making (4).

EMOTIONAL DISTORTION AND EMOTIONAL AWARENESS

Emotional experiences are vital sources of motivation of our actions, but there are good reasons for taking a stronger thesis seriously as well, namely that emotional life is a crucial source of relevant information. Recent research on emotions, value and practical capacities (Roeser, 2011; Tappolet, 2012) follow classic phenomenologists (Husserl, 1952; Scheler, 2007) in suggesting necessary connections between having certain emotions and the apprehension of value information. At the same time, emotions are infamously known for standing in the way of rational thought, reasoning and decision-making. It is fairly easy to provide proto-typical examples of emotions which evidently often distort cognition and reasoning, something also evidenced in empirical research (Haidt, 2001). Negative emotions, such as hatred, anxiety, annoyance and jealousy, can obviously stand in the way of seeing things clearly. But also positive emotions, such as love and hope, can be meaningfully said at times to 'blind' the person being affected.

With this background, an ambiguous picture of the relation between emotions and cognition emerges, and closer analyses of what distinguishes cognition-conducive emotional life from emotions that distort our cognitive processes are called for, not least in the context of learning (Fiedler, 2014). As we shall see, this distinction should not to be analysed in terms of 'good' and 'bad' types of emotion *per se*, but rather in terms of the way in which emotional life shapes attention.

How does it more precisely make sense to talk of emotions as being possible sources of information and cognition relevant to learning? A first step is to recognise that just as our emotional life motivates our actions, so does it influence our awareness. When I feel that something is X, it is not merely the case that I am inclined to act in a certain way, but my attention is also drawn towards X. For instance, if I fear that my students have not prepared for class properly, my attention is automatically drawn towards this probability.

A second step is to recognise that emotions can often be correct or incorrect. This must be properly understood of course: The point is not to say that people are wrong, in a blameworthy sense, in feeling a particular way when they have a so-called 'wrong emotion'. Blameworthiness seems to presuppose some level of autonomous control, which is not always the case in emotional life. 'Correct' and 'incorrect' emotions must be understood here in an *epistemic* sense:

The main point is that emotions are often *intentional* (by some definitions even by necessity) (Ferran, 2008; Goldie, 2002). In and through experiencing an emotion, something is presented to the subject, and such presentation can be more or less in correspondence with the facts. My intensely felt worry, for instance, that my students have not prepared for class properly, is epistemically incorrect, insofar as they are in fact generally well-prepared, or if it poses no real problem that they are not prepared; basically, it is epistemically incorrect, if there is really nothing to worry about. On the other hand, the emotion can arguably itself be a main source of my awareness, insofar as it is well-grounded and given that it is the mental state in which I in fact

present the matter. This is an important point in the context of addressing emotions in learning activities and a point worthy of further clarification.

Firstly, a note on terminology is called for: by 'emotion', I understand in the following any feeling that is intentional (and thus 'cognitive') in the above sense of being presentational of something. Whether all feelings are presentational is controversial and not a question that is essential to answer in the present context. Often, intentional emotions are distinguished from moods and mere feelings by exactly pointing to the fact that the latter are not presentational, at least not in the sense of presenting distinct objects. To illustrate this, my above-mentioned worry is clearly a worry about something, but is my bad mood, or the itchy feeling on my back, directed at anything in particular? It is beyond the scope of this chapter to go into this discussion, and I shall address only emotions that are intentional.

In order to analyse how emotions can be said to be 'cognitive' in a sense relevant to learning, in the following I sketch the basic elements of what I take to be the most viable theory of emotion, what can be labelled a phenomenologically-informed appraisal theory of emotion. I draw the contours of the basic aspects of an emotion, including its presentational and valuational components.

Commonly experienced emotions, such as happiness, hatred, shame, compassion, sorrow, fear, pride, worry and resentment, can be reconstructed phenomenologically as complex *Gestalt* phenomena. That is, as phenomena experienced as wholes or unities, yet constituted by a complex of distinguishable elements, the united composition of which forms a unique totality. This whole cannot be reduced to the sum of its parts, and its parts cannot be adequately grasped separately from each other. The components of what is experienced in episodes of emotion are more precisely only abstract parts – in phenomenological parlance: 'moments' (Smith, 1983) – of the whole emotional experience. An experienced emotion can be analysed as being composed of three basic structural parts (Engelsen, 2016; Ferran, 2008; Roseman, 2001):

Basic structure of experienced emotion:

    (1) Doxastic information

    ↓

    (2) Axiological information

    ↓

    (3) Affective response
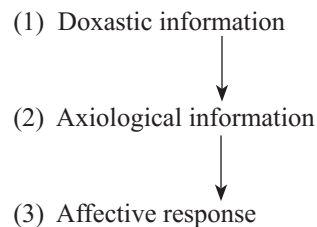
In this scenario, experiencing an emotion is basically characterised by having an *affective response in and through something being experienced as negative or positive* (Engelsen, 2017 forthcoming; Husserl, 1950 §37). The arrows in the

model indicate a relation of foundation: This means that in an emotion, no affective response occurs without an appearance of something that is *worthy* of such an emotion, i.e. without a value appearance in a basic phenomenological sense (soon to be defined more clearly), and an appearance of value in an emotion is always an appearance of *something* being valuable. More specifically, an emotional event includes an appearance of something being the case, i.e. basic doxastic information (1). This simply means that something is being presented *about which* there is the emotion. The emotion is characterised by intentionality: Being directed at something different from itself, an object – whether concrete or abstract, whether inanimate or living – is presented to the individual in and through the emotional experience. An emotion is thus not merely a non-cognitive reaction to stimuli, but is itself a presentation of something. An emotion can take the form of a distinct propositional belief, or it can be a presentation of a simpler kind, i.e. potentially belief-forming information given in non-propositional experience. The doxastic information can have various sources, e.g. sense perception, memory or imagination. An emotion of fear, for instance, can be directed at various objects in a variety of ways. Whether I perceive X, remember X, hear from others that X, or imagine that X is likely to be, X can be the object of my attention in an emotional mode of presentation.

The second structural part, the axiological information (2) is the evaluation or 'appraisal' aspect of the emotion: Emotions never present value-neutral objects, but are always directed at things appearing to be of positive and/or negative value. Regardless of ontological worries about the existence or relativity of value, this point is a basic *explanandum* to any explanation of valuating praxis: We experience things in the world, not as neutral in relation to the lives we lead, but as being of positive and negative value. Importantly, 'value' must be understood here in very broad terms: Anything experienced by the subject as significant and meaningful in any positive and/or negative way, whether in a self- or other-regarding sense and whether intrinsically or instrumentally, counts as being an appearance of value in this understanding of the term. To give an example, worrying about my students' lack of preparation and what this does to their learning and my teaching, I do *not* interpret the situation as neutral: This situation appears negative, first and foremost with regard to the students' learning.

The third structural aspect of an emotion is the affective response (3). This component is that aspect of the experienced emotion which is felt by the subject in a certain positive or negative way. Put differently, the affective response is itself a valenced – i.e. positive or negative – reaction *to* what is being experienced as being *of* value, positive or negative. Such valence is felt as more or less intense, corresponding to how strong the emotion is, and often (but not by necessity) corresponding to how positive or negative something is valuated to be. Worrying that my students have not prepared, I have a negative feeling about this assumed fact. There is a certain negative way it is like to feel this worry; even if it is not very intense it is nevertheless a distinct feeling. Often (if not always), the affective

response of emotion takes the form of a physical experience, an arousal, constituted by various bodily experiences depending on the emotion type, e.g. stomach-ache, sweating, blood rushing to the head and other parts of the body, an 'uplifted' physique, 'chilling' or 'warm' feelings, the heart pumping, 'chills' down the neck, goose pimples, nausea and so forth.

The term 'emotion' can sometimes be used to denote solely the affectual aspect of emotional experience. An important phenomenological point, however, is that if we are to properly understand what an emotion is, it makes no sense to abstract (3) from (1) and (2): As mentioned earlier, the relation (1) → (2) → (3) in the presented model is a relation of foundation: The arrows indicate a point about the causal connection between modes of experience, but since there is no way to properly understand the affectual response in complete abstraction from the connection to the other modes of experience, the relation is not merely causal, but is also constitutive. Put differently, since the causal connection is arguably necessary – i.e. if you experience an affectual response connected with an intentional emotion, by necessity it is connected with a specific doxastic and axiological phenomenal content – the connection is an ontological one. The affection is precisely by necessity a response to an interpretation of a given situation, comprised at least of the other two components (which notably can have very complex social and individual causes, distinguishable from the phenomenon itself), and its meaning can only be adequately understood in light of these. As mentioned, when having an emotion, the experiencing subject experiences all three structural parts as one totality, and to reduce emotional life to the element of the affective response is an abstraction from the original mode of experience of emotions.

To say that emotions are 'cognitive' with the background of the above model of emotion might be misleading, due to the vagueness of this term. If, for example, 'cognitive' mental states are meant to refer to propositional states, distinct beliefs and judgments, or the like, emotions can hardly be said to hold this property necessarily, since aspects (1) and (2) can arguably exemplify non-propositional modes of presentation: Emotions can be indistinct and are not immediately comparable to clear thoughts. Some emotions occur in the 'periphery' of attention, meaning that they are a part of experience, but the person feeling them has no thematic focus on them. Just like hearing a sound can be the audible appearance of a buzzing tone that one does not become aware of until it has gone, an emotion can be vague and unattended to as it is experienced, and perhaps only distinctly recognised when looking back on a prior event of experience and reconstructing it: "Oh, I see now that I was worried, but I was too caught up in other stuff to take notice of it at the time".

Importantly in the present context, the affective response is conditioned by an experience of the situation as providing doxastic and axiological information, but in turn the response typically brings the mind to *attend* to such information, in particular (but not exclusively) to the axiological information parts (Engelsen, 2016; Ferran, 2008; Roseman, 2001):

Basic structure of experienced emotion:

(1) Doxastic information

(2) Axiological information

(3) Affective response
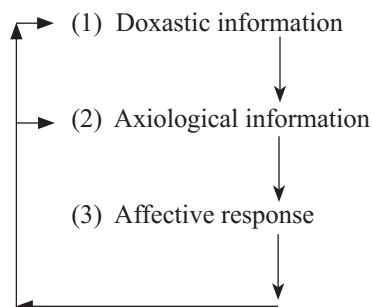
The more intensely a given affective response is felt (3), the more it tends to prompt the person feeling them to pay attention to the value appearance (2), but certainly also typically to what is valued (1). The more I fear something, the more I tend to pay attention to the negative aspects of what I fear; the stronger the joyful affection of my emotion is, the more I am prompted to attend to the good things about which I feel joy. The point that emotions and value sensitivity coincide in this way and that the affective response prompts value attention is important, since *it implies that in and through emotional life, we are able to present value information*. In the case of (contingently or necessarily) other-directed emotions such as compassion, sympathy or gratitude, or negative emotions such as jealousy, indignation or worry, value content is given. This means that such other-directed emotions can be a person's *de facto* main sources of information about what has value in the eyes of others, information that is arguably vital in most teaching situations.

Emotions are certainly not always epistemically fruitful, as is well known: With the background of the presented model of emotion, we can also make sense of and explain a central aspect of the way in which emotions can distort one's cognitive abilities in learning environments. As mentioned, the more intensely an affective response is felt, the more prompted the mind is to pay attention to the value appearance (cf. 2) of the emotional experience. In the case of a very strong emotional response, it is psychologically difficult, in some cases perhaps even practically impossible, to attend at all to other things. A way to describe the negative impact on one's cognitive awareness in such a case is that the emotion creates a restricted and narrow focus of attention. I can be 'caught up' in my joy, fear or worry, i.e. I can get very narrowly and exclusively focused on that which appears joyful, fearful or worrisome. Paying attention to other things and considering things in a wider perspective becomes neglected as a result, and cognitive processes in need of such a perspective – e.g. many processes of practical reasoning – are distorted.

But, however fallible and otherwise problematic emotional experience can be, it can still constitute genuine awareness, since without it one might not be sensitive to vital information in the situation at all (Engelsen, 2017 forthcoming). Emotions

are in this respect more akin to perception than cognition proper (Ferran, 2008): Just like, for example, a visual impression can be so strong that it blinds me from seeing anything else (suppose a very strong beam of light is suddenly directed at me), it would be wrong to say that I receive no information from my visual experience in such a case. What the impression does in this case is precisely to prevent me from receiving other sensory information due to the intensity of the impression. In parallel, my perspective can be distorted by, for example, my joyful experience that two students are having a meaningful discussion, given that it might prevent me from paying attention to the fact that the rest of the class is not learning anything in the situation, but that does not prevent my emotion of joy from being a main source of my awareness of what, from an isolated perspective, is something worthy of joy, namely the students' meaningful debate.

In general, other-directed emotions can be argued to be important in many learning contexts involving teacher-student relations. Other-directed joy is a prototypical example of an emotion often exemplifying genuine emotional awareness, which leads to emotions generally having important functions in many learning contexts. Such other-directed emotional experience is arguably often a good means for apprehending the importance of another person's feelings and perspective in a situation, which is crucial in teacher-student relations.

Let me illustrate this once again in a learning context: Without giving any thought to my worry about the students' lack of preparation for class, this emotion nevertheless forms part of my 'peripheral' experience, and as such it is shaping my attention, motivating me to act in certain ways and, importantly, prompting me to attend to certain things. Suppose I am being very cautious about how to present the topic of the day; I am perhaps attending minutely to how the students participate in class and present their inputs in communication, and I anticipate how little they are learning from our dialogue, as well as considering what to do about the problem. Such attention to specific details of the situation could be a result (at least in part) of my worry that is lurking in the back of my mind. The more worried I feel, the more I tend to address the object(s) of the worry.

We shall soon return to the analysis of this function of emotions shaping attention in a teaching context. Before that, however, I will turn to the student perspective and the analysis of the constructive role that emotional experience can play as an important means for student learning.

EMOTIONS AS A MEANS FOR STUDENT MEANING-MAKING AND MOTIVATION

Emotions can be an important means for student learning due to their function of being sources of meaningfulness and motivation in a learning environment: At the most basic level of experience of value and meaningfulness, conscious emotions can be argued to be fundamental, since occurrent emotions and feelings of value from a phenomenological perspective can be reconstructed as constitutive of the formation

of the very meaning of something being intrinsically valuable to the experiencing subject. Husserl describes value apprehension in experiences of feeling as a 'taking-as-value' (German: *Wert-nehmung*) (Husserl, 1952§4). With the German terminology, he emphasises an analogy between basic value comprehension and sense-perception, *Wahr-nehmumg*, a 'taking-as-true'. The main point is that we seem to present value in emotional experience in a non-inferential and direct way, analogous to the way we present things directly through ordinary perception, not least in contexts of self-regarding value being given in experience. This is arguably the case due to intentional feeling being the original mode of presentation of value and normative meaning as such (Engelsen, 2017 forthcoming), in parallel to, for example, visual sensation being the original mode of presentation of colour. The formation of complex intentional objects of value can be argued to be conditioned by (perhaps internalised) phenomenal content, which is originally disclosed only in specific feelings, in a way parallel to the fact that representing coloured objects is arguably conditioned by having (had) basic visual experiences of prime colours (Husserl, 1999§16; Jackson, 1986, pp. 291–295). In short, you need to have (had) certain lived-experiences of feeling in order to make sense of the basic meaning of value. As mentioned earlier, emotional responses connected with such emotions as joy, fear, love, surprise, disgust and curiosity are all valenced experiences, and it is arguably necessary to undergo them in order to adequately grasp the corresponding value concepts (the fearful, joyful, etc.), on the basis of which value judgments are formed.

Meaning-making experiences and intrinsic motivation are closely connected with value experience in the phenomenological sense. An important structural aspect of value experience is that something is appearing itself to provide the experiencing subject with a reason for acting in certain ways: Feeling something to be in itself positive entails that it is experienced as being itself significant and reason-providing (Engelsen, 2013, pp. 54–56; Parfit, 2011). Phenomenologically, the appearance of such reason-giving quality is in accordance with something appearing to be intrinsically motivating, i.e. motivating not as a means to an external goal, but as an aim in itself. Meaningfulness experienced in a context of learning (Shuman, 2014) is an experience of something being a sensible learning objective or learning activity, whether as a means or in its own right. When something connected with learning is experienced as being of intrinsic value, it is thus also a case of meaning-making and at the same time intrinsically motivating.

Interestingly in the context of value experience in learning contexts, students' intrinsically motivating meaning-making experiences often involve 'seeing the positive *in* the negative'. Learning can for instance be hard work and at times incorporate experiences such as frustration, but it can also, and even at the same time, be given emotionally as rewarding, fulfilling, eye-opening (e.g. an 'aha moment', a sudden insight or inspiration), uplifting, something manageable and empowering (Fiedler, 2014, pp. 43–44) and perhaps even be felt as promising in relation to future projects. Another interesting aspect of the experience of meaningfulness in processes of learning is that in and through experiencing it, the student's attention is

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often absorbed in the subject matter at hand. This is clear in cases of flow experience in learning processes (Csikszentmihalyi, 2003), often a source of emotionally strong meaning-making episodes. Consider the case where two students are completely absorbed in their discussion of the right interpretation of a movie. Their sense of themselves and of time and place is not in focus at all; on the contrary, their learning is experienced as *itself* meaningful in and through a focus away from themselves, away from what they are doing and from the context they are doing it in, and onto the movie as something of interest in its own right: Their process of interpretation derives its experienced meaningfulness from the fact that their subject matter at hand – as opposed to external considerations in relation to it – is itself appearing to them as intrinsically valuable and reason-providing in and through their presentation of the matter in emotional modes of presentation.

Experiencing meaningfulness in processes of learning is a topic worthy of much more extensive phenomenological analysis. Having established how emotions can generally enable awareness to value and how emotional experiences can themselves exemplify and be a means to meaningful learning experiences in a student perspective, in the following I turn my focus to the teacher perspective. I investigate how emotions, when appropriately regulated, can help teachers facilitate their sensitivity towards what is experienced by students as meaningful and motivating learning.

EMOTIONS AS A MEANS FOR THE TEACHER'S SENSITIVITY

The importance in many learning environments of the teacher being sensitive to students' perspectives can hardly be overstated. From the theory of the relation between emotion and awareness presented above, it follows that having certain emotions and being sensitive to things as being of value are intimately connected. Importantly, as mentioned, such emotional sensitivity arguably includes being sensitive to *value regarding others*.

Emotional experiences are often the very means by which we understand others. Whether we feel sadness, joy, rage, love, curiosity, contempt or sympathy in our understanding of other persons, in and through such other-directed emotions we present features of their situation more or less correctly: Following the model of the structure of emotion above, intimately connected with having a certain affective response (cf. 3), another person's inner states can be presented (cf. 1) as being positive or negative in a certain way (cf. 2), and the affective response prompts the feeling subject to attend specifically to the value presented. The perspective of others is important in this connection. Presentation through other-directed emotions includes a possible sensitivity to what is positive and/or negative in a specific other-regarding sense. In the context of learning, we can highlight the two important functions of other-directed, emotional value-sensitivity based on this background, namely that teacher emotions can be a means for becoming aware of students' motivation, as well as their meaning-making as described above. Let me illustrate the point by further developing the case of the students interpreting a movie:

As a movie is discussed in class, Teacher T feels a strong joy about the fact that Students S1 and S2 are completely caught up in their joint analysis of the movie, even though the content of the debate itself strikes T to be trivial, and even though the movie seems to her to be boring. It is the very fact that this debate is rich and valuable *to S1 and S2* that T comprehends in her feeling joy; the fact that T recognises the value not as a value to her specifically, but as a value as seen from their perspective, makes it no less a value experience to T. It makes it an other-regarding value experience. Through her emotion of joy, the debate basically appears to T to have value for S1 and S2, and thereby a complex value-*Gestalt* is presented in T's experience, which notably includes an approximation to important aspects of the students' perspectives. In and through feeling the emotion of joy about the students' commitment, positive aspects of the situation as such are appreciated. This can include anticipation of the positive outcomes of the students' commitment in a learning perspective, but notably can also imply something more basic, namely an *approximation to how this situation is experienced from the point of view of S1 and S2*:

In other words, T's joy involves an empathetic identification with the students, given that T's joy implies a perspective-taking, and this includes (if successful and correct) a case of other-directed understanding. It entails that she can recognise the experienced intrinsic value, as seen from the students' perspective, as important in its own right, i.e. the value as such of being in a state like that of S1 and S2 (Engelsen, 2013, p. 241; Klawonn, 2004, 2007; Zahavi, 1999). A structural part of feeling something to be in itself positive is that it is experienced as being itself significant and its own reason (Engelsen, 2013, pp. 54–56; Parfit, 2011). Put differently: Aside from having important potential instrumental educational effects, being in the flow of joint learning about how to analyse the movie – conceiving it from different interpretative angles, identifying with the protagonists, dissecting the story plot, appreciating the aesthetic effects, etc. – is experienced by S1 and S2 as an aim in itself, i.e. as intrinsically meaningful as well as motivating. This is recognised by T in and through her joyful emotion approximating to the students' perspective, notably without T making the same sense of the movie and the discussion first-personally as the students do, yet in an affective (i.e. joyous) mode of presentation she nevertheless recognises the situation as being of other-regarding value. This is consistent with a response-dependent account of value suggesting that the value of objects and states of affair are dependent for their existence on certain types of human responses, and that the apprehension of the value of objects must therefore include an apprehension of such responses (Engelsen, 2013; Wiggins, 1987).

The process of interpreting the movie is experienced by the students as intrinsically interesting, and the basic point is that the teacher *recognises this fact in and through enjoying the situation*. Thus, for T, experiencing an emotion of joy is in this case the very means by which she comprehends the fact that the students are intrinsically motivated and involved in meaning-making learning. Given the structure of emotion, the joy of the teacher is not a mere arbitrary affective reaction; the affective response of joy is a response to and a prompting of attention to an appearance of value given

as regarding the students, and the emotional state of joy instantiates an awareness of the fact that this learning process is motivating and a case of meaning-making for the students.

Aside from joy, such emotions as compassion, sympathy, curiosity, enthusiasm and passion would arguably be proto-typical examples of emotions that are often important means for apprehending meaning-making and intrinsic motivation in learning contexts. But we should not rule out a priori the relevance of any emotions (even negative ones) to value sensitivity in learning contexts, since if the phenomenologically-informed appraisal model of emotion is correct, any emotion is a potential source of relevant information.

CONCLUDING REMARKS

It is important not to jump to hasty conclusions about the practical consequences of the above analysis. Firstly, it does not follow from the analysis that it is a priori impossible for a teacher to apprehend students' intrinsic motivation or meaning-making in non-emotional modes of presentation. In that respect, the point is rather a more defensive one: We should not neglect the constructive importance of emotions as possible means for awareness. Secondly, we should certainly not jump to the conclusion either that for the aim of promoting meaningfulness and motivation in learning environments, teachers and students should generally focus on being as emotional as possible. Emphasising how emotions can serve crucial functions in being sensitive to intrinsic motivation and meaning-making should not, of course, blind us to the deeply problematic nature of many emotions in many learning contexts. As mentioned, being absorbed in emotions in inappropriate contexts can result in the distortion of attention, e.g. in the sense of resulting in an inability to see things in a wider perspective.

The lesson is rather one of highlighting the importance of making room for appropriate student emotions that are conducive to meaning-making and motivation in the learning environment, and for cultivating emotional maturity in teachers. Such emotional maturity includes being open to various types of emotion, corresponding to being able to attend to different forms of value information, meaning-making and motivation in students, and it implies an aptitude for regulating the intensity of one's own emotions, not just in the sense of being able to down-regulate affective responses, to 'keep one's cool' in order to think and act rationally when needed, but also in the sense of having the context-sensitive ability to *up*-regulate emotions when appropriate (Engelsen, 2016; Tiberius, 2008). Such an emotion-regulation skill further requires the teacher's meta-cognitive ability to monitor her own emotional dispositions, as well as a context-sensitive awareness of how certain emotions are appropriate in different learning situations and how others are not. These are all relevant topics for further investigation. The promotion of emotional awareness is important, not just for such purposes as making sense of being a student or a teacher, or avoiding burn-out etc., but as an important teaching and learning tool in itself.

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5. MOTIVATION, LEARNING, AND THE EDUCATIONAL DIALOGUE

INTRODUCTION

These days, students in Danish elementary schools are experiencing a greater sense of boredom. In a Danish evaluation (Dansk Center for Undervisningsmiljø [DCUM], 2010), 29% of students in elementary school reported being bored often, and in another more recent evaluation (DCUM, 2014), the number of students who reported being bored increased from 19.3% for fourth- to sixth-grade students to 28.4% for seventh- to ninth-grade students (Wellnitz, 2016, in progress). Some researchers have termed this expansion in the boredom of elementary and secondary schools students experience as a motivational crisis (Hutters & Katzenelson, 2012; Sørensen, Hutters, Katzenelson, & Juul, 2013). In particular, older students in sixth to ninth grade experience motivational problems. A variety of different studies (see, e.g., Wigfield et al., 2015 for a review; Wellnitz, 2016, in progress) show a general steady decline in students' motivation and engagement throughout their time in school. This decrease in student motivation is problematic, as student learning is negatively influenced if low motivation is present (Wellnitz, 2016, in progress). Furthermore, there is a strong dynamic component involved in the experience of boredom and low motivation among students in elementary school, which causes it to spread from students to teachers. One way of confronting experienced boredom and low motivation is to introduce different kinds of educational interventions that are supposed to raise student motivation in the educational system, such as cooperative learning, problem- or project-based learning, and classroom management (Wellnitz, 2016, in progress).

   In this paper, it will be argued that we need to understand the motivational crisis and the growing experience of boredom as a theoretical problem rather than merely a practical problem. The lack of student motivation and the experience of boredom must be understood in connection with the theoretical assumptions about how to arrange the Danish educational system, which are currently evolving. The dominating educational paradigm of the last ten years can be framed as the learning-objective paradigm. Historically, the pupil-centered paradigm has been the ruling paradigm in Danish education, where educational arrangements take the needs and perspective of the student as a point of departure when organizing education. In Denmark, the pupil-centered paradigm was first formulated in the 1930s by Sofie Rifbjerg, reformulated in the 1970s within the frames of critical pedagogy by Knud Illeris and again reformulated in the 1990s in a more individualistic framework centered on Bjørgen's mantra about

the student being responsible for his or her own learning (Nielsen & Tanggaard, 2011). The theoretical roots of the pupil-centered paradigm were founded on the naturalistic ideas about education of Rousseau, Fröbel and Montesorri, among others, and theoretical assumptions about learning were strongly influenced by humanistic psychologists such as Rogers and Maslow and developmental psychologists such as Piaget (Nielsen & Tanggaard, 2011). It goes without saying that the pupil-centered paradigm had a strong focus on the pupil or the student's learning processes, and the educational arrangement was often associated with organic nature metaphors (e.g. kinder*garden*, focus on individual *growth*, *growing* up, or understanding learning as *a seed* within the person that develops over time and through experience) (Nielsen & Tanggaard, 2011). Within the last decade, the pupil-centered paradigm has been met with a devastating critique arguing that there was too much focus on the pupil and too little focus on the content of the education and student performance (Nielsen, 2016). In 2003, inspired by poor Danish results in PISA, the former Danish premier minister Anders Fogh Rasmussen condescendingly called the pupil-centered paradigm a "circular pedagogic" ("rundkredspædagogik") meaning that the Danish pupils and teachers were involved in a never-ending conversation without really learning anything (Fogh Rasmussen, 2003).

Under the influence of globalization, increased international competition and new public management in the 2000's, the learning objective paradigm has become the dominating paradigm within educational thinking in Denmark (Dolin, 2016). The learning objective paradigm has strong roots in an Anglo-Saxon curriculum tradition and the fundamental idea is that educational activities are regulated by a number of specified learning objectives (for an elaboration, see Qvortrup, 2016). The learning-objective paradigm was politically prepared by the liberal government in the 2000s and implemented in 2011 by the social democratic government, which legitimized it with the ambition of making Danish students perform better in international comparative assessments like PISA and TIMMS (Nielsen, 2016). As will be elaborated in this paper, the learning objective paradigm not only introduces another perspective on how to organize education, but it also introduces another way to conceptualize student participation in educational practice and hence student intentionality and agency compared to what is found in the pupil-centered paradigm. As will be outlined below, the learning objective paradigm replaces the humanistic psychological and Piagetian theoretical framework with a behaviorist framework especially inspired by Skinnerian thinking. Below, it will be argued that the work of John Hattie—one of the key educational researchers whose research is used to legitimize the learning objective paradigm—has strong roots in behaviorist thinking, especially as formulated by Skinner. This paper will argue that with a reintroduction of Skinnerian behaviorism through the learning objective paradigm, the educational system might run into the same problems that Skinner's work ran into five decades ago, namely a conceptually underdeveloped understanding of student intentionality and student agency leading to a growing sense of boredom among students and lack of motivation.

THE LEARNING OBJECTIVE PARADIGM AND
THE RELATIONAL MODEL

If we take a closer look at the learning objective paradigm, it does not only contain a focus on defining a set of learning objectives. Standardized outcome measures in the form of national tests and a strong focus on examinations play a significant part in the learning objective paradigm, making it possible for the government to account for input (economic resources) compared to output (test and examination results). Following the learning objective paradigm, a strong comparative gaze has evolved between schools and nations, making it possible to compare output production among schools and among nations (through e.g. PISA or TIMMS). As mentioned above, the dominating metaphor in the pupil-centered perspective was taken from organic nature, whereas the dominating metaphor for the learning objective paradigm is the metaphor of production and technology (Biesta, 2015a, 2015b).[1] According to Biesta, metaphors of production and technology conceive education as a piece of machinery where there are inputs, mediating variables and measurable outcomes and where issues of teaching and learning are defined as mediating variables between inputs and outputs (2015b, p. 16). In this respect, the students are conceptualized as subjects who are to be formed by the educational system, and they do not stand out as persons who could have intentions of their own.

I will give a short and perhaps provocative example of how students are conceptualized within the frames of the new learning objective paradigm. If we take a look on the homepage of the Danish Ministry of Education, they suggest to teachers that they should use the relational model to implement the learning objective paradigm (Undervisningsministeriet, 2017). The relational model is characterized as a square with four corners, each of which represents a central theme. The central themes are (1) learning objectives, (2) teaching activities, (3) feedback and (4) signs of learning. The relational model addresses nicely what this paper would like to problematize: namely the lack of a conceptualization of student intentionality and student agency. The learning objectives in the model are already defined (in "Forenklede fælles mål") and are not open for negotiation, and in that respect, there is no need to conceptualize student intentionality and agency. Hence, the student (and the teacher, for that matter) is seeing responsive non-thematized objects in the relational model. In the following I will analyze the relational model from the perspective of Skinnerian behaviorism. I will use the relational model to describe Skinner's famous experiment modifying rats' behavior in his Skinner box from 1938 (Skinner, 1948; McLeod, 2015). The example is to show how similar the vocabulary[2] of the relational model (based on the learning objective paradigm) is to Skinner's ideas about behavior modification.

Based on Thorndike's law of effect (1905), Skinner developed Thorndike's notion of operant conditioning into the analytic concept of reinforcement, which means changing behavior by using reinforcement (Skinner, 1938). Skinner showed how positive reinforcement worked by placing a hungry rat in his Skinner box. The

box contained a lever on the side, and as the rat moved around the box it would accidentally knock the lever. Immediately, a food pellet would drop into a container next to the lever. After being put in the box a few times, the rats quickly learned to go straight to the lever. The consequence of receiving food if they pressed the lever ensured that the rats would repeat the action again and again. According to Skinner, positive reinforcement strengthens a behavior by providing a consequence an individual finds rewarding. Behaviorists discovered that different patterns of reinforcement had different effects on the speed of learning and on extinction. Ferster and Skinner (1957), for example, devised different ways of delivering reinforcement and found that they had different effects on response and extinction rate.

If we use the relational model described on the ministry of education's homepage based on ideas from the learning objective paradigm, we can easily explain the process of Skinner's experiment with the rats. The learning objective is to increase the rats' frequency of pushing the lever. The rats get feedback through the pellets they receive. The sign of learning is the increased frequency with which the rats pushing the lever. And if we include the test dimension, it is possible to account for the rats' performance through charts of the frequency with which the rats pushed the lever compared to the frequency of reinforcement. In the relational model and Skinner's theory of learning, there is an understanding of the student as being active; however, there is no concept of student intentionality or agency.

The example of comparing the ministry of education's relational model founded on the learning objective paradigm and Skinner's famous experiments with rats is crude and meant to be provocative. However, it provides a fine clue to the problems with the learning objective paradigm. In the following, it will be argued that one of the central researchers behind the learning objective paradigm, John Hattie, is equally inspired by behavioral modification thinking and, again, his work lacks a concept of student (and teacher, for that matter) intentionality and agency.

HATTIE AND THE REFORMULATION OF BEHAVIORISM

In the following, it will be argued that one of the central researchers behind scientifically legitimizing the Danish version of the learning objective paradigm is the New Zealander researcher John Hattie and his formulation of "visible learning." Some researchers have talked about "the Hattierevolution" (Qvortrup, 2015), and others have presented Hattie as the researcher par excellence, on whose results the teachers in the Danish primary schools can (and should) build their teaching. Sceptics are warned: "People who refuse to use Hattie's and others' results accept a substantial moral responsibility" (Hansen et al., 2015, p. 7—my translation). There is no doubt that Hattie's focus on learning objectives, feedback and signs of learning has been a great inspiration for the relational model described above.

Hattie's work about "Visible Learning" (e.g. 2009, 2012, 2015) is a synthesis— that is, an interpretation of a large body of empirical material mainly consisting of a huge number of meta-analyses of effect studies. It is a synthesis of a very

large amount of meta-analyses (at the time of writing around 1,200 meta-analyses are included) that makes Hattie's work the largest ever undertaken in educational research (Polanin et al., 2016). The many meta-analyses are calculated into a number of single effects (at the time of writing, Hattie's list includes 195 such effect sizes). The original book *Visible Learning* (2009) consists of the analysis of more than 52,000 single investigations. Despite Hattie's impressive quantity of empirical material, it can be argued that Hattie's theoretical assumptions about learning and education are strongly embedded in a behavioristic framework, especially as it is formulated by Skinner (for an elaboration, see Klitmøller & Nielsen, 2017; Nielsen & Klitmøller, 2017).

If we make a brief comparison between Hattie's work and behaviorism, most notably Skinner's work, there are a number of similarities. As mentioned above, a central idea in behaviorism is the notion of stimulus response, or as in Skinner's case, the concept of reinforcement. We find the same structure as being central when it comes to the structure of Hattie's approach to research. Hattie's fundamental structural approach to educational research is a matter of input-output or stimulus-response, and each of the 195 effect sizes are outlined in the book *Visible Learning* (Hattie, 2009). Every effect size presented in Hattie's "Visible Learning," visualized as a small speedometer, is the result of a specific kind of stimulus, which implicitly argues that it is possible (and reasonable) to differentiate between 195 kinds of stimuli (independent variables) in order to identify 195 effect sizes/responses (dependent variables) (Klitmøller & Nielsen, 2017). The stimulus-response (or input-output) matrix is central for both Hattie and behaviorism. The individual person's overt and observable behavior is the central analytical unit in behaviorism. A central dimension in Hattie's work (and his famous key word) is to focus on *visible learning*, or as mentioned in the relational model mentioned above, signs of learning. Again, both in Hattie's work and in behaviorism, learning shows itself in behavioral change, not in change of student intentions or experience of meaning (Klitmøller & Nielsen, 2017). In behaviorism, there is a strong focus on formulating achievable goals or learning objectives. We see the same tendency in Hattie's work, and it goes without saying that the formulation and measurement of learning objectives are central to the learning objective paradigm. A central dimension in Hattie's theory is the notion of feedback, which, it can be argued, plays the same role in Hattie's theory as the concept of positive reinforcement does in Skinner's learning theory.[3] Skinner defines positive reinforcement as the consequences of the individual actions that lead the individual to increase the frequency of a given behavior (O'Donohue & Ferguson, 2001, p. 92). Hattie's concept of feedback works within a reinforcement logic where the continuous feedback process constantly makes information work as one part of a reinforcement mechanism—namely, in the role of reinforcer, it increases a form of behavior that makes the student able to realize the goals formulated within the frames of the educational system (Klitmøller & Nielsen, 2017). Finally, it should be mentioned that if we take a closer look at some of Hattie's first works on learning, effect sizes and education in schools, he is strongly influenced theoretically by

Glazer's work (see e.g. Hattie, 1987). Glazer is a former student of Skinner and a central figure in American education for introducing Skinner's work and transforming it from the laboratory to the school organization (see e.g. Resnick, 1989).

THE LACK OF STUDENT INTENTIONALITY AND AGENCY IN HATTIE'S WORK

One of the main problems in Hattie's work is the lack of conceptualizing of human agency and intentionality. In Hattie's work about visible learning there is no concept of students' interests, intentionality or understanding of school or of the role school life plays in their own lives—no concept of the student as meaning-seeking or interpretive. When Hattie talks about students' experiences it is only in relation to the way in which students may be susceptible to the teacher's influence. In short: although the students must be active (no activity means no feedback) they are not initially understood as intentional. The students' intentionality and uniqueness are replaced by an understanding of how effective they are at solving problems. Instead of addressing students as agents and student intentionality, Hattie talks about, for example, self-efficacy, self-handicapping, self-motivation, self-goals and self-dependence (Hattie, 2012; Hattie & Yates, 2014). These concepts do not come from Hattie's own empirical work, but from a variety of partial theories of primarily cognitive origin. All these different concepts are Hattie's replacement of the student's own interpretation of the relevance and importance of school and serve Hattie's ambition of supporting the student in becoming his own teacher. The starting point is not to understand the teaching situation or the school from the students' perspective, but a way to find aspects of student activities that may be subject to correction so that the image of students as problem solvers can be maintained.

He is addressing educational issues from the school's and the teacher's point of view (and from a particular school and teacher understanding), reflecting the students as objects under the school's or the teacher's influence rather than addressing school issues from the perspective of how the school plays a role in the students' lives. Furthermore, given Hattie's approach to education, human dialogue seems be replaced by a strong focus on mutual processes of feedback between the teacher and the student, and there is little focus on giving reasons for why the students should learn what they should learn. In other words, there is a need to reformulate how we should understand issues of education.

The Return of the Problems with Behaviorism

The learning objective paradigm has been celebrated as a success since the latest PISA measurement, wherein Danish students moved from a position at the bottom of the PISA scales to a position in the middle (Rambøll, 2013). However, as mentioned in the beginning of this chapter, we are beginning to see a decrease in student motivation and a growth in experienced boredom. As argued in this paper,

it is not a coincidence that we are beginning to see a decrease in student motivation. It is linked to an educational practice based on a learning objective paradigm in which the relevance of what students learn is not considered important. This lack of consideration for the student perspective is a consequence of the learning paradigm having an underdeveloped understanding of student intentionality and agency. It is interesting that the critique voiced in this chapter regarding a lack of conceptualizing of human agency and intentionality has a strong similarity to a critique that was voiced against Skinner's behaviorism five decades ago. The critique claimed that Skinner's versions of behaviorism, human beings' intentionality and agency were not sufficiently developed, and this laid the foundation for more elaborated understandings of human learning (O'Donohue & Ferguson, 2001).

It can be argued that it is problematic to exclude human agency and intentionality when addressing issues of human learning and development. The German philosopher Honneth stresses the importance of recognizing persons' agency and intentionality as crucial for their development as autonomous participants (Honneth, 1996; Nielsen, 2016). Conversely, according to Honneth, failing to acknowledge or recognize autonomy and intentionality could lead to a state of social alienation (2008). Honneth's philosophical considerations and the empirical observations outlined in the beginning of this chapter seem to be supported by empirical studies. Based on meta-analyses of 128 well-controlled experiments, Deci, Koestner and Ryan (1999) concluded that educational arrangements based on engagement-contingent, completion-contingent and performance-contingent rewards (i.e., good grades in testing) undermine students' intrinsic motivation (p. 653). These results were in alignment with previous studies (Ryan & Deci, 1985; Grolnick & Ryan, 1987; Ames, 1992) arguing that the growing number of tests in schools (as part of the learning objective paradigm) has the "side" effect of decreasing students' intrinsic motivation and their ability to develop to monitor processes of self-regulated learning (Harlen, 2003; Harlen & Crick, 2002). The growing sense of boredom and lack of motivation (the motivation crisis) mentioned in the beginning of this paper could be seen as an example of this development (DCUM, 2014; Wellnitz, 2016, in progress).

REPLACING FEEDBACK WITH THE EDUCATIONAL DIALOGUE

The central argument of this chapter is to argue that there is strong need to expand the conceptualization of student (and teacher, for that matter) intentionality and agency in the learning objective paradigm. The intention has not been to do away with the learning objective paradigm or to reintroduce a child-centered paradigm again. One way to expand the learning objective could be to introduce the students as co-constituents in producing the meaning and the objectives of what school is all about as a dynamic part of educational practice (Klitmøller, 2016, in review). The purpose of schooling should not only be something that comes from "outside" or from "above" as the current practice of the learning objectives indicates (e.g., from the government, the municipality, school boards, or from the teachers).

As argued by Cullingford (2002, 2006; Klitmøller, 2016, in review), students have surprisingly little experience in even being presented with the reasons for the tasks they are asked to perform or the content they are taught. In other words, there is a need to reinstall the educational dialogue, where students are recognized as being serious speakers whose arguments should also be taken seriously when it comes to educational matters. Students should be included and invited in formulating the aims and purposes of their education as a part of the educational process. Rather than seeing feedback as the core of educational activities as suggested by Hattie, it would be more productive to reinstall the educational dialogue as the central means in educational activities.

Based on Habermas's theory of communicative action, and specifically discourse ethics, Løvlie (1984) suggested an educational framework for reintroducing the educational dialogue. The presupposition is that the participants are recognized as being capable of giving reasons for their actions (Klitmøller, 2016, in review). They are fundamentally recognized as responsible speakers. The ideal framework of reinstalling the educational dialogue, where the participant must accept the authority of the better argument and the ideal, is one in which the participants abstain from strategic and rhetorical activities (Løvlie, 1984). Rather than blindly reproducing the forms and content of previous generations or giving in to the idiosyncrasies of the individual, it is the dialogue based on the better argument that has the authority:

> For both parties the interpretive task consists in incorporating the other's interpretation of the situation into one's own world in such a way that in the revised version "his" external world and "my" external world can – against the background of "our" lifeworld – be relativized in relation to "the" world, and the divergent situation definitions can be brought to coincide sufficiently. Naturally this does not mean that interpretation must lead in every case to a stable and unambiguously differentiated assignment. Stability and absence of ambiguity are rather the exception in the communicative practice of everyday life. (Biesta, 1994, p. 310)

The ideal for the educational dialogue is not agreement but consensus in order to develop shared understanding; the participants must accept the better argument as valid for future action (at least until an alternative and mutually accepted "better" argument is presented; Løvlie, 1984). This also includes changing the roles of teachers and students into a symmetric participant relation and, at the same time, claiming an asymmetric relationship between participants, giving priority to participants who have strong arguments based on knowledge and insight. It could be argued that the educational dialogue based on developing the best argument would provide the opportunity of legitimizing learning objectives.

It is important to underline that the educational dialogue and the authority of the better argument should be seen as reinstating an ideal for educational activities. It goes without saying that, in an everyday, practical and educational life, there are a number of reasons why it can be difficult to realize consensus; however, it is important

to develop an ideal for educational activities. The notion of the educational dialogue based on the better argument could ideally pave the way for both students and teachers to develop good reasons for accepting or resisting particular learning objectives.

NOTES

1   For an analysis of the link between the technology metaphor and behaviorism, see Kvale (1976).
2   The strong emphasis on the notion that teachers should work explicitly with classroom management is yet another example of the revitalization of behavioristic thinking within the frame of the learning objective paradigm (for an elaboration of the behavioristic roots of classroom management, see Rachlin, 1991).
3   See Kluger and DeNisi (1996) for a historical analysis of how the concept of feedback has its roots Thorndike's work. As mentioned above, Thorndike's concept of operational conditioning is pivotal in Skinner's development of the concept of reinforcement.

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6. LEARNING OBJECTIVES AS FRAMEWORKS AND RESOURCES IN UPPER SECONDARY EDUCATION

Between Means and Aims

INTRODUCTION

Within the last few years, the educational shift from content-based to outcome-based or competence-based curricula has manifested itself in a great interest in learning objectives and what we call learning objective-oriented education. This includes an enhanced interest in, as well as debate on, how learning outcomes are operationalised into learning objectives in study regulations and syllabus/lesson plans. The focus on outcome and learning objectives has altered the conditions of and focus points for education (Carlgren, 2016; Qvortrup, 2016). But how can we understand the altered conditions and the ensuing changes in today's teaching practices? If outcomes and learning objectives are actualisations or operationalisations of the aims of education, what does the accentuation of these mean to the practice of teaching? Do learning objectives help to clarify the aims of education for teachers and students and thereby form a basis for describing categories for assessment and evaluation (Dolin, 2016)? Do they form an incentive to choose what Carlgren (2016) calls a reverse pedagogy, where learning objectives dictate didactical choices? Or is learning objective-oriented education just the technocratic and time-demanding operationalisation of work that teachers already do (Misfeldt & Tamborg, 2016)?

With Luhmann's second generation systems theory as our theoretical framework and based on a literature review and empirical studies in three upper secondary schools, we examine the use of learning objectives in Danish upper secondary schools. Our approach is not evaluative, but exploratory and descriptive. By looking at what teachers and students actually do, our aim is to answer the question: How are learning objectives realised within upper secondary education, how do teachers and students experience and respond to them and how do these experiences contribute to their expectations of and participation in teaching?

Based on the studies, this chapter suggests that learning objectives are used by teachers in an ongoing mediation of the communication with students in order to set direction, stay focused and keep on track. This is done, for example, by accentuating sudden aspects of learning, such as needs or prerequisites, and by evaluating student

success. Furthermore, the objectives are used in the teachers' re-didactisation to support didactical choices in teaching and to reduce uncertainties. The objectives often refer to the national curricula, but also the tradition of the subject and teachers' values and beliefs play an important role. Altogether, this chapter draws a picture of learning objectives as being engaged in complicated conversation. This chapter contributes to current research on didactics in upper secondary education by approaching the question of objective-oriented education from an empirical perspective, and by shedding light on teachers' and students' use of and experiences with learning objectives. By doing so, it takes a step towards a professional theory and conceptual framework for objective-oriented education, which is fundamental for a systematic, reflective practice. In a wider perspective, by bringing up questions that are traditionally absorbed in research and practice within the Anglo-Saxon curriculum tradition, and then exploring them with theories and practices retrieved from the German and Scandinavian tradition of didactics, this contributes to the dialogue between didactics and the curriculum tradition, initiated by Gundem and Hopmann (1998). It continues Englund's (2007) project to develop a new language for the problems hitherto described in curriculum theory and didactics.

THEORETICAL FRAMEWORK

According to Luhmann (1995, 2002a), teaching and learning can be described as self-referential and functionally-closed processes, which take place in social and psychic systems, respectively. Social systems are described as systems operating on communication, and psychic systems are described as systems operating on consciousness (thoughts, sensations and imaginations) (Luhmann, 1995, 2002b). Both types of systems produce themselves with reference to themselves in closed circuits. Hence, social systems communicate what they communicate and psychic systems think what they think (Luhmann, 2002b). The idea of self-reference does not exclude the possibility that teaching, as a social system, and learning, as events in a psychic system, can affect each other. Teaching and learning are mutually closed at the level of operation, but open at the level of observation and cognition, due to so-called structural couplings. Language plays a fundamental role in the structural couplings between psychic and social systems, as it can be used as a *medium* for both thinking and communication, and accordingly it allows the two types of systems to deal with the same topic, each in their own specific way (Luhmann, 2002). This mutual influence is often described in terms of 'disturbances' or 'perturbation' (Luhmann, 1995, p. 385). Communication can disturb, but not determine thinking, and vice versa. Figure 1 from Keiding and Qvortrup 2014 illustrates the closedness and self-reference of psychic and social systems and their structural coupling. It also illustrates how two psychic systems can only affect and observe each other through communication (verbal as well as non-verbal).

The operations of both psychic systems and communication can be described in terms of observation. Luhmann describes observation as the handling of distinctions:
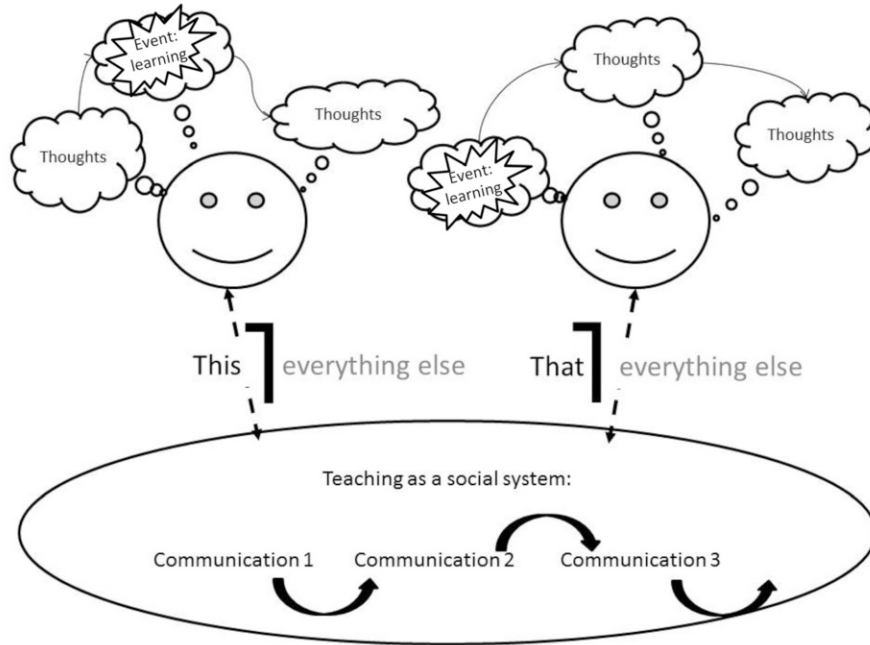
Figure 1. Functionally-closed psychic systems based on thoughts, sensations and imaginations, where learning may emerge as events, and their structural coupling to chains of communication in the social system where teaching as communication takes place (after Keiding & Qvortrup, 2014b with learning events added)

Observations are asymmetric (or symmetry-breaking) operations. They use distinctions as forms and take forms as boundaries, separating an inner side (the Gestalt) and an outer side. The inner side is the indicated side, the marked side. From here one has to start the next operation. The inner side has connective value (Luhmann, 2002: 101).

Luhmann uses Spencer-Brown's (1969) form notation to illustrate the distinctions of operations. As illustrated in Figure 1, any operation can be described as 'this⌉ everything else'. In an observation, something – 'this' – is chosen, and anything else is left out. With this it becomes evident that in a systems theoretical perspective, contingency is a basic condition for communication (Luhmann, 2000: 149ff).

Luhmann describes modern society as functionally differentiated (1990, 1995a, 2012). Over time, society responds to enhanced complexity by functional differentiation, that is differentiation into societal sub-systems such as economics, law, science and education, each of which manage a specific aspect of the total societal communication. The function of a sub-system can be described through a number of characteristics, such as the coding of the system's communication, the

reflection theories of the code, the way the system reflects its function and the institution through which it delivers its performance. Education is a sub-system. It performs the societal function of educating and forming careers through teaching in schools. The aim is to teach students what they are expected to require in order to participate in future societal communication. In this sense, education is orientated towards 'intended changes' and towards the main code of the education system, which is better vs. worse knowledge (Luhmann, 2002a). Curriculum, didactic theory and educational research are the reflection theories of the education system, i.e. the theories for reflecting on what is better or worse knowledge and whether education has the intended effect on students (Luhmann, 2006, p. 117; Qvortrup, 2016; Qvortrup & Keiding, 2017).

The systems-theoretical framework underlines the significance of learning objectives. Learning objectives can be seen as the communicative anchoring of the curriculum, or the aims of education. However, the description of social and psychic systems draws attention to learning objectives (and curriculum and aims) as products of distinctions used in concrete settings (Luhmann, 2002). Since different distinctions produce different information and different points of departure for future selections, systems theory also makes topical the idea of focusing on how learning objectives are used in actual situations. In doing so, it accentuates the importance of looking at different systems. This is also known from curriculum theory with its distinctions between programmatic, planned, realised and evaluated curricula (Pinar et al., 1995) and between explicit and implicit/tacit or hidden curricula (Kelly, 2009). With its focus on distinctions, systems theory offers a highly systematic, analytical tool for describing how the different curricula emerge through the use of distinctions, and for describing how interpretations of learning objectives, i.e. expectations for valuable learning, are both products of and produce the curricula (Keiding & Qvortrup, 2014). This gives us a sound background for describing how, for example, study programmes might contain learning objects that teaching as a social system rejects, or due to conditioning factors, is unable to observe. It allows us to observe how new learning objectives emerge through interpretations shaped by former experiences, habits and beliefs about subjects and learning (Hoban, 2002; Lindhart, 2007; Skott, 2001, 2009; Lortie, 1975), and how the various learning objectives influence decisions in teaching.

The above suggested analytical points have great similarities with Pinar's (2012) concept 'complicated conversation', which he uses to describe curriculum work. As described above, in a systems-theoretical perspective, the classroom can be seen as an autopoietic system, operating in communication assigned to the condition of contingency. This is sustained by ongoing mediation through language. The concepts of 'complicated conservation' and 'ongoing mediation' help us to understand two important processes of teaching. However, these concepts do not capture the way teaching aims to fulfil its societal function. Pinar says, ''when we understand curriculum as conversation, it means (…) that the academic disciplines are ''living traditions'', although this characterisation does not address the problem

of their educational significance" (Pinar, 2012:194). Curriculum as complicated conversation is not (just) communication. It is communication performing the function of teaching students what they are expected to require in order to participate in future communication. If ongoing mediation captures the process of establishing a dynamic of communication, we also need a concept to describe how teaching attempts to help students participate in a way that makes them fit into the 'better' side of the betterⅠ worse distinction. As Pinar notices: "The question then becomes how we can orchestrate these conversations so that students can enter into them?" (Pinar, 2012: 197). It becomes important to invite "students to encounter themselves and the world they inhabit (and that inhabits them) through (…) their own lived experience" (Pinar, 2012: 214). Inspired by Ongstad (2006: 35f.), we suggest the concept of didactisation as the concept for the communicative processes specifically related to disciplinary subjects and the aim of education. It is widely accepted that didactisation processes are not fixed and do not result in unequivocal changes of practice. This means that re-didactisation processes take place in the classroom during lessons, where re-didactisation, as Hansen (2007) suggests, is understood as the teacher's ongoing transformation of the lesson plan during teaching and in interaction with students and with the physical and organisational settings (Hansen, 2007: 45). The prefix 're-' marks a difference from previous teaching practice: "Previous ways to plan and organise lessons are not only transferred or translated. A re-didactisation is also happening, in the sense that the known teaching and learning methods [are] re-formed and changed in their manifestations" (Sørensen et al., 2004: 58 in Hansen, 2007: 11).

This way of understanding didactisation and re-didactisation does not apply any limits to these concepts. According to Hansen (2007), "teachers' re-didactisation means that it is teachers' didactical glance, intentions and criteria that form the material and its information value" (Hansen, 2007: 205). Learning objectives are in this sense "characterised by being a loosely-coupled didactic media, a meta-didactografi which is formed on the basis of the teacher's didactic design" (ibid: 205). Inspired by Hopmann, one can assert that a main characteristic of didactisation and re-didactisation processes is selection: "It is always a question of selection" (Hopmann, n.d.: pp. 145–146). Hopmann emphasises the intimate link between teaching as didactical practice and selection. The quotation specifically addresses selection of content, but the meaning applies to every category of didactics. It is neither self-evident what to educate for, nor what content, methods and technologies will promote the intended learning outcomes among students with different qualifications and different interests. The specific selections may refer to the body of practices and knowledge about teaching that the single teacher, each team or the educational institution possesses, or it may refer to the reflection theories of the education system. However, every selection marks a difference and becomes "the difference that makes a difference" (Bateson), since different didactic positions reflect and present teaching in different ways, and accordingly they offer different stories about what teaching is or should be (Qvortrup & Keiding, 2014). For instance, progressive pedagogy argues that teaching must be rooted in students'

experience, oriented towards purposeful actions and holistic in content and modes of expression (Dewey, 1916; Kerschensteiner, 1971; Kilpatrick, 1918; Röhrs, 1982). In contrast, learning objective-oriented didactics emphasises the relevance of explicit and transparent learning objectives, sequencing and feedback (Biggs & Tang, 2011; Mager, 1962; Möller, 1973; Tyler, 1949). Didactics rooted in the German tradition of education (Bildung) tends to focus on how education can contribute to empowerment, social responsibility and democratic attitudes (Gundem & Hopmann, 1998; Klafki, 1998, 2000; Reid, 1998). Also, social learning theory is strongly orientated towards communities of practice and collaborative processes (Lave & Wenger, 1991; Wenger, 1998). These theories run in very different directions, but all of them suggest ways by which the aims and means of education become the aims and means of the individual student. According to Luhmann, in order to achieve a position as reflection theory, certain ambitions must be pursued: "It must be thoughtful descriptions seeking to meet ambitions about consistency. They cannot let wishful thinking and fantasy run wild. It is not theories in the sense of scientific programmes in the scientific system, but descriptions, which are orientated towards structural couplings to the scientific system and which have to claim something, which, though it is scientifically unsatisfactory, cannot refute soon after it is claimed" (Luhmann, 2002: 203). With all these possibilities, it is the teacher with his/her professional judgment and experience who makes the final decision. According to Luhmann, decisions are everything a system regards as a decision (Luhmann, 2003: 35). A decision event indicates a discontinuity, a differentiation between what comes "before" and "after" (Luhmann, 2003: 36), and the decision will be constituted as the transformation of the form of contingency. "Before the decision, several possible decisions exist, thus the space of open possibilities is limited. After the decision, the same contingency exists in a fixed form: the decision could have been made differently – it is now contingent upon itself" (Luhmann, 2003: 36).

Method

In order to be able to reflect the use of learning objectives in Danish upper secondary schools, we wished to create an analytical framework on competing norms, reference points and practices on learning objective-oriented education emanating from various local, national and broader social and cultural contexts. To do this, a systematic literature review was carried out in the ERIC database. With reference to Randolph (2009) and Cooper (1988), the review is classified according to six themes: "*Focus, Goal, Perspective, Coverage, Organisation and Audience*" (Randolph, 2009: 2). The Goal is described above: to create an analytical framework. The Focus consists of didactical possibilities and limitations in learning objective-oriented education, with a special view on its significance to teachers' and students' participation and space for action. The Perspective is upper secondary schools, and the Audience consists of researchers and others with interest in the circumstances surrounding objective-oriented education. Based on this, we chose 'educational' AND 'objectives' as the entry search

words. Furthermore, we delimited the search to include only peer-reviewed articles published within five years (publication date: since 2012). The temporal delimitation was decided because the school system has undergone several reforms over a number of years and in recent years it has experienced a significant shift in the use of learning objectives. With this search approach, we got 4,316 hits. To narrow down the hits, we made a delimitation with the descriptors 'Secondary Education' and 'Educational Objectives'. This resulted in a total of 168 hits. These were screened for relevance and meaningful statements were highlighted. 18 articles were marked as being particularly relevant, all of them focused on upper secondary education. This included studies that were diverse in terms of method, theoretical and analytic approach. It also included both theoretical (Harðarson, 2013; Pudelko & Boon, 2014; Redelius et al., 2015) and empirical studies (Styllianides & Styllianides, 2014; Lyvra et al., 2015; Pudelko & Boon, 2014; Redelius & Hay, 2012; Verhoef et al., 2014; Kelly et al., 2013; Redelius et al., 2015; Olteanu & Olteanu, 2013; Havnes et al., 2012), building on respectively the tradition of curriculum (Styllianides & Styllianides, 2014; Pudelko & Boon, 2014; Kelly et al., 2013) from the USA, Australia and England, and the tradition of didactics (Lyvra et al., 2015; Harðarson, 2013; Redelius & Hay, 2012; Verhoef et al., 2014; Redelius et al., 2015; Olteanu & Olteanu, 2013; Havnes et al., 2012) from Finland, Iceland, Sweden, the Netherlands and Norway. The studies were also diverse in terms of subject: Physical education (Lyvra et al., 2015; Redelius & Hay, 2012; Redelius et al., 2015), Mathematics (Verhoef et al., 2014; Olteanu & Olteanu, 2013), Norwegian (Havnes et al., 2012), Science (Styllianides & Styllianides, 2014) and English (Kelly et al., 2013). They were also diverse in terms of method: Case studies (Styllianides & Styllianides, 2014; Pudelko & Boon, 2014; Verhoef et al., 2014), Survey (Lyvra et al., 2015; Redelius & Hay, 2012), Theoretical studies (Harðarson, 2013), interview (Redelius & Hay, 2012; Redelius et al., 2015), Observation (Kelly, Hochmann, Pratt, & Dorf, 2013), document analysis (Olteanu & Olteanu, 2013) and intervention studies (Havnes et al., 2012).

Besides the literature review, a case study was carried out consisting of seven cases in three upper secondary schools. All three schools are characterised by being orientated towards learning objective-oriented education. Two of the upper secondary schools (cases 1–5) are situated in rural districts, while the third school (cases 6 and 7) is situated in a suburban district. The seven cases, hereinafter referred to as Case 1 to Case 7, differed in several parameters:

Case 1: 2nd year class, subject observed: Mathematics. Female teacher with 14 years of experience
Case 2: 2nd year class, subject observed: Danish. Female teacher with 6 years of experience
Case 3: 3rd year class, subject observed: Biology. Female teacher with 9 years of experience
Case 4: 2nd year class, subject observed: Physical education. Male teacher with 2 years of experience

Case 5: 2nd year class, subject observed: History. Female teacher with 8 years of experience

Case 6: 1st year class, subject observed: Danish. Male teacher with 35 years of experience

Case 7: 2nd year class, subject observed: Mathematics. Male teacher with 8 years of experience.

Each case study combined participating observation (Kristiansen & Krogstrup, 2015) and semi-structured interviews (Kvale & Brinkmann, 2015) with teachers and students (two focus groups with 4 students per single case study). Each observation had a duration of two lessons (150 mins) and were supported by an observation guide, just as the interviews were based on an interview guide (semi-structured). On the basis of our literature study, three keywords were chosen for the guides: Learning objectives, reference point for selection and classroom praxis. Each observation was followed by respectively a teacher interview and two focus group interviews with students. The interviews aimed to explore each participant's conception of the learning intentions and learning objectives. The interviews were audiotaped and transcribed verbatim. The combination of methods enabled us to follow the curricula from the programmatic level (1) onto three different sublevels of the practical curriculum: the planned (2), the taught (3) and the experienced (4) curriculum. Furthermore, it allowed us to address the interpretation of learning from three positions of observation: the teacher, the students and teaching as interaction.

Learning Objective-Oriented Education Observed from a Literature Review

In this section, we will observe competing norms, reference points and practices on learning objective-oriented education as they appear in a literature review. The concept of learning objective-oriented education is observed from different perspectives throughout the included studies. The most important distinctions and observations that emerge through the studies are listed.

The review reveals a variation in how students (Lyvra et al., 2015; Havnes et al., 2012; Redelius et al., 2015) and teachers (Harðarson, 2013; Redelius et al., 2015; Olteanu & Olteanu, 2013; Stylianides & Stylianides, 2014; Kelly et al., 2013) use and perceive learning objectives. Regarding the use, we found differences in the types and levels of goals, aims and objectives that were used. Some studies use a hierarchical division some into aims, goals and objectives (Lyvra et al., 2015), others into individual mastery and performance objectives, and others focus to objectives having to do with the improvement of society, and/or into objectives focused on respectively creativity and self-expression and more hedonistic objectives (Pudelko et al., 2014; Harðarson, 2013). A hierarchical differentiation is used to highlight that teachers and students often have varying and overlapping interpretations of learning objectives (Lyvra et al., 2015; Havnes et al., 2012; Harðarson, 2013), and this defines an aim as an overarching purpose or intent (e.g. lifestyle), while objectives are

defined as the achievement of broad outcomes (e.g. skill acquisition) and objectives are mentioned in reference to more specific outcomes (Lyvra et al., 2015).

A number of factors – explicit and discernible as well as more implicit and less discernible – of great significance to the use and perception of learning objectives were identified. The explicit and discernible factors are such as the setting, the participants, available teaching aids and media (Redelius et al., 2015). The more implicit and less discernible factors are experiences, values and norms brought about by the teacher, the classroom, students and other interested parties, such as colleagues, inspectors and parents (Kelly, Hochmann, Pratt, & Dorf, 2013) and wider organisational, social, cultural and historical contexts that teachers' and students' work is embedded in (Qvortrup & Keiding, 2014; Keiding & Qvortrup, 2014; Olteanu & Olteanu, 2013). These factors interact and result in competing goals (Ball, 2006; Kelly, Hochmann, Pratt, & Dorf, 2013; Olteanu & Olteanu, 2013).

In addition to the factors mentioned above, the variation in uses and perceptions of learning objectives seems to be the result of a variation in the understanding of which functions learning objectives are proposed to undertake (Stylianides & Stylianides, 2014; Pudelko & Boon, 2014; Verhoef et al., 2014; Kelly et al., 2013). Pudelko et al. (2014) define objectives as *cognitive representations of future events that motivate behaviour*, and refer to classic achievement goal theory that focuses on two types of academic goals; mastery goals, also labelled Learning goals, and performance goals, labelled Ego involvement goals. Central to mastery goals is the desire to learn new skills and truly understand content based on self-referenced standards. Central to a performance goal is the demonstration of one's skills with a focus on ability, which is gauged by comparison to others or to normative standards. In another study, learning objectives serve a function as a means to the broader purpose of equality (Harðarson, 2013). A Norwegian study is focused on the differences between the use of learning objectives as a framework for feedback in respectively vocational and academic secondary education (Havnes et al., 2012).

Corresponding to this chapter's concept of complicated conversation, Redelius and Hay propose the communication of learning objectives as a means to reduce contingency: "In a school system employing a criterion-referenced grading approach, defining the purpose in terms of what students should learn, is required, not the least for reasons of validity and students' legal rights to be equally assessed" (Redelius & Hay, 2012:215). In this way, learning objectives become a means for teachers to communicate selection criteria to students. Redelius and Hay conclude that to promote a better alignment between the official assessment expectations and students' perceptions of assessable elements, greater syllabus clarifications should be provided regarding assessment practices (Redelius & Hay, 2012:211). In a later study by Redelius (Redelius et al., 2015) she asks if communicating aims and learning goals are part of a subject for learning. This study concludes that "many of the students taking part in the study do not understand what they are supposed to learn" (Redelius et al., 2015: 641). However, if teachers communicate learning objectives clearly, the study concludes that students are more likely to be aware

of what to focus on. The study also concludes that if learning objectives are not communicated in a clear way, students find it difficult to state what they are supposed to learn (Redelius et al., 2015). Success in complicated communication is related to reduced complexity. In these studies, learning objectives are proposed as a means in communication to increase students' focus on selection criteria.

Within complicated conversation, learning objectives are mediated, renegotiated and stretched out between what Olteanu and Olteanu (2013) describe as a continuum spanning over the intended, the enacted and the lived objects of learning, a range that connects teachers' planned dimensions of variation with aspects discerned by students (Olteanu & Olteanu, 2013: 516). In an observation study, Kelly et al. (2013) examine how teachers manage the mediation. They point out that teachers' professional identities are important to be successful within this ongoing mediation, because it helps teachers to position themselves. Knowledge about subject content, teaching approaches and students' learning processes is highlighted as being essential, together with didactical reflection. "Professional identity concerns questions such as: What kind of a teacher am I? What is important to me in teaching? Which ways of working do I identify with? How do I view different subjects?" (Kelly et al., 2013: 631). The study concludes that the observed teachers "move smoothly between goal-oriented behaviours in a continuous and comfortable style, easily and without reflecting any tensions between them" (Kelly et al., 2013: 609).

From a teacher's perspective, the mediation and renegotiation that Kelly et al. (2013) talk about seem to be related to didactical rationality. A study from the Netherlands explores the changes in mathematics teachers' learning objectives and instruction strategies when using both instrumental and relational learning objectives to reflect their teaching. This study concludes that teachers do change with respect to their learning objectives and didactical choices, but "it is a slow and idiosyncratic process" (Verhoef et al., 2014: 876). The study shows that the process of teachers' re-didactisation is not an easy one, and it is tightly connected to and dependent on both complicated conversation and on teachers ongoing mediation. "This study reveals the significance of the complex reality of Dutch school practice. Mathematics education is driven by examination objectives, study guides based on textbooks and the desire to realise high exam results" (Verhoef et al., 2014: 877).

On the whole, the review demonstrates how learning objectives represent both a potential with regard to developing better education and also a useful means in communication to increase students' focus on selection criteria. It also shows great differences both in the various functions learning objectives are expected to handle and also in the conditions that influence the use and perceptions of learning objectives.

Learning Objective-Oriented Education Observed from Seven Case Studies

In this section, we will observe possibilities and risks in learning objective-oriented education as they appear in seven case studies. The overall result from the case

studies is that learning objectives can function as a communicative reference point in the important process of establishing a teaching communication dynamic. With this, they can support the fulfilment of the aim of the educational system, which is to teach students what they are expected to require in order to participate in future societal communication. In the seven cases, this manifests itself through a focus on how learning objectives support either *education as communication* or *education as career selection*. However, we also find examples where learning objectives seem to work against the aim of education. In the following, we will proceed systematically by exploring the results on how learning objectives seem to support or counteract the two aspects of education.

In Case 7, the teacher indicated that the learning objectives, which he put forward in their online course management system, Lectio, functioned as a means to aim the education by sketching a picture of the learning trajectory he intended the students to follow. This picture helped him to stay focused during the lesson.: "*Well… I actually think, that the learning objectives mainly are helpful to me as a teacher. I am not even sure if my students read them in Lectio. The objectives help me to be more exact on what I have to include in my teaching. They help me to stay focused on what my students need to know. In mathematics, it is very tempting to dive into unimportant details as students pose questions. But it takes time. Learning objectives help me to stay on track*" (Teacher, Case 7). This teacher was not that focused on communicating the learning objectives to his students. To him, learning objectives are a tool for himself, to keep him on track while teaching. They support didactical rationality, as we talked about in the literature review. The idea that learning objectives can be used by teachers was emphasised in the study by Stylianides and Stylianides (2014) on the role of Instructional Engineering as a teaching method to reduce the uncertainties of Ambitious Teaching. The method is based on the use of learning objectives in highly refined instructional plans to reduce uncertainties and reach the learning process intended by teachers (Stylianides & Stylianides, 2014).

The seven case studies showed great variations in teachers' clarity in the communication of learning objectives. The teacher in Case 1 was very clear in her communication: ""*Today's learning objectives are: I know how to find the apex of a parabola*". *The teacher also did write the learning objective in the students One-Note. She read it out loud several times. The students seemed to concentrate when listening. She asked the students to indicate with a thumb mark whether it was ok for her to continue. All the students gave her a sign with their thumb – most of them with a thumbs up and others with thumbs straight. The teacher decided to continue the lesson*" (Observation Case 1). Also in Case 4, the teacher was very explicit in his communication of learning objectives. He explained: "*I can tell that it makes a big difference for the students. In lessons where I have been very specific about the objectives, it seems to be easier for the students to deal with subject content*" (Teacher, Case 4). He described the use of learning objectives as a way to make communication less complicated. In his estimation, the learning objectives helped students to relate to subject content. This description corresponded to Redelius'

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and Hay's (2012) proposition that learning objectives can reduce contingency. They can be seen as the communicative anchoring of the curriculum or the aims of education, as we talked about during the presentation of the theoretical framework. This is accentuated by the teacher in Case 4, who said that: "*It is very important that students know what is central to the education, that's why I present sub-objectives to them on a slide. I always introduce them to the learning objectives followed by a reflection exercise (…) My feedback is also related to learning objectives. I don't just say "Way to go!" or only praise them. Feedback needs to relate to the learning objectives*" (Teacher, Case 4). This teacher seems to point out that a process of ongoing mediation is necessary for students to relate to learning objectives. In Case 1, a student explained that he had made significant improvements in mathematics in upper secondary school compared to primary school and he was convinced that the clearly communicated learning objectives have made the difference: "*When I look back at maths in ninth grade, (…) the teacher just went through her stuff and obviously I didn't learn very much (…). And so I just sat there, asking myself, what do I need this for? What is it all about?*" This student reflected on teaching in primary school as a time with no clear learning objectives, where teaching did not make much sense to him, a time with no clear aim. This has changed due to teachers' use of learning objectives: "*I think it's a great initiative, when the teacher tells us; "This is what you need to learn" and "It makes sense in this context" (…) It makes sense, when there is something to relate to. Then you have the desire to learn more (…) Learning objectives motivate me, and help me to see why I'm in this maths class*" (Student, Case 1). In Case 2, one of the students explained: "*I use them (learning objectives communicated by the teacher) very much. (…) I use them to navigate, so that I know when to listen carefully. They become my focus of attention*" (Student, Case 2). Both our case studies and the review indicated that learning objectives can help students to understand what teaching is about. They help students to construct sense and meaning and allow them to relate to the educational aspects of the subject (Redelius et al., 2015). Relating to our theoretical framework, one can say that they are important anchorage points in the didactisation processes. However, not all students find learning objectives to be a useful sense-making tool. Some students who presented themselves as successful students found them less useful, like this girl in Case 2: "*Sometimes I just think that we are at a kindergarten level. Like small children who need to have everything structured. (…) Yes there are some who need this kind of structuring and that's ok. But to pull an entire class into it, where many of us don't need it, that's not ok. If we always must remember to help the weak ones along, others just waste our time*" (Student, Case 2). Several studies on gifted or talented students also point out the necessity to work towards learning objectives (Laine et al., 2016; Reis & Renzulli, 2009), but the objectives must be aimed at them. "*Teachers, therefore, should differentiate their teaching to take into account the needs of different students*" (Laine et al., 2016:155). The frustrations in the quotations above could be a sign of a student needing greater differentiation in the posed learning objectives.

Above, we have focused on the support of learning objectives in regard to education as communication. Looking at the other aspect, the support of career selection, the use of learning objectives is very often associated with grades and examination, as is also suggested in a study by Verhoef et al. (2014). All of the seven case studies revealed this picture. Learning objectives were used as a means to making the selection criteria more/fully visible to teachers and students. The teacher in Case 3 explained how she used her experience on how students are assessed at the examination when she designed learning objectives: "*My experience regarding how the written examination questions usually are formed, and what the oral exams usually are focussed on and what I experience as a censor on other schools, gives me an idea of what it is we need to work on. Such experience makes it much easier for me to design specific sub-learning objectives*" (Teacher, Case 3). Teachers' experience with exams is not only useful to them in the formulation of learning objectives. In Case 5, the teacher explained how she also used it in her communication to the students. "*Sometimes I tell them, we have these learning objectives, and when we reach summer you will all have a history exam to pass. There, you will surely be presented with these historical source texts, which you have to read and be able to reflect in relation to the issue you have chosen to dive into. This kind of argumentation I use to illustrate the relevance of the learning objectives*" (Teacher, Case 5). To both the teachers and the students, it seemed clear that this way of making the standards of the coming examination clear by using learning objectives was an important driver of the students' motivation. In Case 3, a student said: "*We have just finished a course theme on 'not paying too much attention to grades'. But it is just… It is not easy. (…) It can destroy so much for you, if you can't enter higher education because of your grades*" (Student, Case 3).

When learning objective orientation in relation to education as selection was observed in the seven cases that focus on learning objectives, it was seen that teachers used learning objectives as a means to communicate the expectations for, or the standards of, the coming examination. We saw how one of the teachers experienced that this was a way to justify and give meaning to the learning content.

Table 1. Summarising respectively teachers' and students' perspectives on learning objectives with regard to the functions of the educational system

	Selection	*Communication*
Teachers	Means to reduce complexity or uncertainties on selection criteria.	Means to communicate expectations, e.g. on standards. Means to justify and give meaning to content.
Students	Means to underline selection criteria, experienced as an important and serious part of education.	Means to give meaning to content. Means to structure teaching.

We also emphasised how students expressed that it was a positive experience, since it underlined selections as an important and serious part of education.

Distinctions in Learning Objective-Oriented Education

The design and specification of learning objectives are both influenced and conditioned by a broad variety of framing factors. Some of the conditions found in our empirical study related to students' association of learning objectives being a marker of the difference between success and failure in a particular subject, e.g. when students and teachers related learning objectives to the possibility of achieving a high final grade. The teacher in Case 1 was both very clear and systematic in her use and communication of learning objectives. She used them to draw a distinction of success, and explained that she used both the curricula and her 14 years of experience to do this. She chose learning objectives which corresponded to the objectives with the written exam, since "*the exam is one of the strongest motivational driving forces*" (Teacher, Case 1). Several of the students in this case found it both satisfying and helpful that learning objectives were used in this way. The learning objectives helped them to structure and give meaning to subject content. One student said that it left him with the energy to focus on further learning progression. Another student explained how learning objectives made her feel more secure of her skills in mathematics. "*You become aware of whether you have learned anything or not. It gives me such a feeling of, maybe not security (…) And at exams, they give me a sense of certainty (…) I know what I've learned and what I am supposed to have learned*" (Student, Case 1). Other students explained how they used learning objectives as a checklist when they studied for tests. They used them to reflect on their learning process and to set up realistic expectations, as a student explained "*The aim is to achieve the learning objectives presented by our teacher. When the teacher has read the learning objectives to us, then it is very satisfying when I know that I have reached all of them*" (Student, Case 1). The relationship between exams or assignments and learning objectives not only appears prospectively, but also retrospectively. In the case just described, the return of an assignment caused a lively discussion in class, including both teacher and students. Several students raised their hands, the teacher circulated, communicating with students on how to interpret her feedback comments in the assignment. The teacher said that she decided to change the learning objectives due to this discussion (Teacher, Case 1). A student gave another example of this teacher's attention to student communication: "*If we mark with thumbs down, then she will explain it to us all once again, and then it makes sense*" (Student, Case 1). This is a great example of the ongoing mediation and the didactisation between students, teachers and learning objectives.

In Case 3, the teacher presented the learning objectives in the online course management system Lectio and during the lesson, the teacher asked the students three times to evaluate their own work in relation to these learning objectives. Based on their evaluation, she divided the class into three groups. The groups got different

assignments, with different learning objectives linked to them. In the interview the teacher elaborated on the self-evaluation system. "*I have carefully considered whether I should take part in the decision or "allow" students to evaluate and decide it themselves. I actually think it worked really well, to return to the evaluation scheme halfway through the lesson, and then let them consider for themselves if they are up to the next step*" (Teacher, Case 3). By introducing this self-evaluation system, the teacher used the students' self-understanding (as it was communicated to her) to differentiate learning objectives, in order to better aim at the individual student and to make them reflect their own work in relation to the educational aim.

The teacher in Case 6 did not ascribe his use of learning objectives to the increased focus on learning objective-oriented teaching. Focusing on objectives was not new to him: "*I have always thought of the objective and what I want the students to learn. So I would say that it's what I want the students to learn that determines my selection of content, not vice versa*" (Teacher, Case 6). He called attention to a time perspective related to a wish to pay attention to the current needs of the students: "*I only plan my lessons a few weeks ahead (…) I like to have the freedom to feel, what this class actually needs at the moment, and then make decisions on subject content based on this*" (Teacher, Case 6). This teacher was oriented towards student communication as it appeared through the implicit expressions of their needs and feelings: "*I take a glance over the students, and then I can see it in their eyes, whether they are on or not*" (Teacher, Case 6). This state is in clear contrast to the teacher in Case 1, who used the students' thumb signals frequently: "*Yes I use the thumb signals often (…) it's just a really good signal to tell where they all are. (…) what it actually means when they do not stick their thumbs up, I cannot know*" (Teacher, Case 1). The examples show the great variety revealed in the case studies when it comes to the type of student communication teachers interpret as valid in the social system of teaching.

A similar variety was found with regard to teachers' interpretation of student communication as an indication of learning or not-learning. The following sequence illustrates this, as we return to the teacher in Case 6, who said that he was more concerned about students' not-learning or lack of learning than he was about students' learning progression. This became visible in his reply to the question about which signs of learning he considered relevant: "*Signs of learning? Which signs of learning? I will rather say that I pay attention to signs of lack of learning. Like mobile phones, or if they are mentally represented in the classroom and so on*" (Teacher, Case 6). In the observation, one example was presented of the teacher using these *signs of lack of (not-)learning* in students' communication . Several times during the lesson, students made a lot of noise and students hushed other students. Several students used mobile phones during class, they looked at them and typed on them. Some students wore headphones. These observations supported the teacher's statements in the interview. He found it very challenging to get the students to stay off-line and present in the classroom, and this was also a significant sign of the students' lack of learning, which very much influenced the teacher's didactical choices. Another

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example of a sign of not-learning was found in the students' writings about what they had learned in a lesson and what was still to be learned on the subject. "*The writing surely reveals if they didn't learn anything at all*" (Teacher, Case 6).

In several of the case studies, data indicated that school values in the national curricula are a significant condition for the use of learning objectives. All the included teachers mentioned the national curricula (STX bekendtgørelsen) as a decisive condition for their selection and formulation of learning objectives: "*at the beginning of the school year, I make a plan. I start by finding out, how many modules I have got, and then I allot the subjects in regard to how much time I will spend on each. Then I decide the exact content in each theme to make sure I have reached the subject objectives from the national curricula*" (Teacher, Case 2). The teacher in Case 4 explained: "*I start up by formulating and setting up the learning objectives for the specific course (…). This is done by going to take a look at the national curricula*" (Teacher, Case 4), and in Case 6: "*First of all, I have a professional obligation in making them into students in relation to the broad motives of the educational aims found in the national curricula and second, I have a huge task in regard to general bildung (general education), which takes up just as much time and effort*" (Teacher, Case 6). Drawing on the distinction part of the national curricula and using it in the didactical decision process seemed to be common for all teachers in the seven case studies.

Another aspect that conditioned the selection and use of learning objectives was teachers' personal values and expectations. This applied to all seven teachers, who particularly referred to *General bildung* and students' ability to use the subject content in other aspects of life as an overarching aim. An example appeared in Case 4. "*I work out from an understanding of, that every student can and should not learn the same, so I have to stimulate them on different levels. Therefore, they need to learn something 'in', 'about' and 'through' sports or physical activities (…) E.g. in today's lesson, we focused on relational skills*" (Teacher, Case 4). He explained the importance of making it clear to students that what they learnt in class was general skills. "*I try to make it clear to them that what they learn in PE is potentially useful for them in every relationship they take part in*" (Teacher, Case 4).

Other personal beliefs or values expressed by the teachers in our case studies were temporal punctuality (Case 1), students' ability to embrace each other and that all students got the possibility to say something during class (Case 2), the teacher as a good role model (Case 3), teachers' facilitation of the students' learning process by offering a good and safe learning environment (Case 4 and 5), humour (Case 6), or room for breaks during the lessons (Case 7). In Case 2, the teacher found it very important for all students to be able to keep up in class, in spite of a great variety in the students' learning prerequisites. "*Some students are first generation to enter secondary school, while others grew up with the jargon and study methods used here, and they seem clear about what we expect from them. However, for many of our students this is not the case (…) I hope that those to whom secondary school is more strange, learning objectives will make it a little easier for them. The objectives help them to see what they need to concentrate on, so it isn't too abstract for them*" (Teacher, Case 2). This

illustrates how this teacher related her use of learning objectives to her values and beliefs and it shows that to draw the distinction value⌐not value is essential to teacher re-didactisation. This distinction was not only important to the teacher. It also left some students very enthusiastic: "*Learning objectives help me to structure my school work. Then I can take the learning content and put it in a box with an overarching topic*" (Student, Case 2). However, the distinction also left an unmarked side: "*Sometimes I feel we are treated like in a kindergarten. The teachers structure everything for us, as if we were small children*" (Student, Case 2). This is especially applicable for talented or very skilled students (Laine et al., 2016; Reis & Renzulli, 2009).

Not only does the distinction between skilled and non-skilled students play a difference to the re-didactisation in teaching. In Case 5, the distinction of what can be included in the subject's tradition is significant. The teacher explained how the tradition of the subject History could be an obstacle when it came to the formulation of learning objectives: "*students probably aren't that deliberate on the methods they use in this subject. And I must admit that it probably is related to the fact, that we history teachers only talk very little about our methods. Off course we can't talk about it all the time, but we should do it more often*" (Teacher, Case 5). During the observation, this teacher presented a Smiley-card, where the students had to assess themselves with regard to four learning objectives. Two of the objectives were related to the subject content (How well do you understand the Thirty Years War? and How well do you understand the power politics and religious situation of the 1500s and 1600s?). The other two objectives related to subject-specific study methods (How well can you use analytic tools for source analysis? and How well do you know specific historical study methods?). The teacher explained that her wish to raise the students' awareness of subject traditions and culture was essential for her choice of learning objectives. "*I wanted to draw out the major lines for them, by telling them about history-specific methods and how to use them*" (Teacher, Case 5).

Table 2. Five distinctions, which both influence and condition the design and specification of learning objectives

No.	Distinction	Code
1	Students associate learning objectives with the difference between success and failure in a subject.	Success⌐ failure
2	Students participating (as it is observed in communication, implicit or explicit) affect the teacher's choice of learning objectives and re-didactisation.	Participation ⌐ absence
3	National curricula condition learning objectives	Part of the national curricula⌐ not part of the national curricula
4	Teacher's personal values and beliefs	Value⌐ not value
5	Culture and traditions in relation to the subject	Tradition⌐ not tradition

In this section, we have explored the conditions that influence the use of learning objectives in the seven case studies. On the whole, we have identified five distinctions, which both influence and condition the design and specification of learning objectives (see Table 2).

CONCLUSION

In the introduction of the chapter we posed a range of questions related to the function of learning objectives. We asked whether learning objectives help to clarify the aims of education to teachers and students, whether the orientation towards learning objectives forms an incentive to choose a reverse pedagogy where learning objectives dictate didactical choices, or whether learning objective-oriented education is just the technocratic and time-demanding operationalisation of what teachers already do? Most of the teachers in our study have found that the focus on learning objective-oriented education has caused changes to the teaching and to the students and their learning processes. We have shown that learning objective-oriented education can be described as complicated conversation, with learning objectives formed by various conditions assisting multiple means aiming to support different functions. The chapter makes it clear that great variations can be identified in teachers' clarity in the communication of learning objectives. Some teachers are not explicit at all in the communication of learning objectives, while others are very explicit, i.e. when learning objectives are used as the point of reference for feedback. Throughout the seven case studies, learning objectives were used as a means to support the function of career selection by making selection criteria more visible or even fully visible to teachers and students. Both teachers and students have found learning objectives to be very useful as points of navigation that help them to focus their attention. One teacher has found himself practising the reverse pedagogy. However, this is not due to the increased focus on learning objectives, but is something he has always done, and at the same time he is claiming that he has adjusted subject content to the specific class and situation.

The chapter shows that the teachers' experience with exams is used in the specification and design of learning objectives. A teacher explained that she has used learning objectives very directly as a way to communicate exam expectations to the students. Several of the case studies indicated that the Danish national curriculum is a significant factor when it comes to conditioning the use of learning objectives. The national curriculum is used in the specification of objectives related both specifically to the subject and also more generally to broad educational motives and general education. Another important condition was found to be teachers' personal values, like temporal punctuality, students' social abilities, time and room for all students to speak in class, a good and safe learning environment, time for breaks, humour and fun. It was revealed that specific tradition in relation to the subject can be an obstacle when it comes to the specification and design of learning objectives. Furthermore, it was shown that only one teacher has involved

the students in the specification of learning objectives, by using feasibility studies. The teacher characterised it as both difficult and time-consuming, which is why she quickly stopped it again.

In the chapter, we have taken a first step on the road to a professional theory and conceptual framework for re-didactisation of learning objectives. In a wider perspective, this is a contribution to a language for increased and complicated dialogue or reciprocal inspiration between and within respectively the German and Scandinavian tradition of didactics and the Anglo-Saxon curriculum tradition. There is a need to pursue this interest further.

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7. THE DIDACTICS OF GROUP WORK

Between Means and Aims in Theory and Practice[1]

INTRODUCTION

In didactic terms, aims and means in teaching are most often described as 'the what' and 'the how' of the teaching activity (Nordenbo, 1997). While I view the aim as the (overarching) purpose or goal of the teaching activity, I interpret means as referring to methods or 'tools' for the teacher. In this paper, I will discuss the aims and means of group work.

Since the 1970s, group work has been implemented as a teaching and learning method at all levels of education in Denmark from primary school to the university as well as in training sessions in organizations (Borgnakke, 1983; Christensen, 2013). In educational settings, group work is often connected to an explicit rejection of traditional teaching methods, such as classroom teaching and lectures, methods considered as old-fashioned and too teacher-centred (Illeris, 1974; Illeris, 1981; Bertelsen et al., 1977; Hansen, 1997; Jensen et al., 1997). Since group work was introduced as being different from these methods, it was automatically perceived as being 'progressive' and student-centred. In contrast to traditional lectures where the teacher is in charge, group work requires students to be the agents, while the teacher becomes less visible (Frello, 1996; Frello, 1997; Simonsen & Ulriksen, 1997; Simonsen, 1996).

When wishing to discuss the pedagogical means and aims of group work, we first have to define the method, or, rather, distinguish between the many different forms of group work applied in education. Basically, group work in an educational setting that involves two or more students collaborating, learning being the objective. This type of work may be structured as (informal) short-term discussion groups, which are a common element of a traditional teacher-directed lesson. It may also be realized as more formally structured study or project groups of different duration (Rasborg, 1968). The two options are of course very different and entail quite different learning opportunities for the student. The teacher can thus choose the method that best matches his or her intentions.

There may be several reasons for applying group work to a teaching situation. Students' groups are commonly expected to serve as a forum for discussions among the students, which activates the students and improves their learning (Illeris, 1974; Illeris, 1981; Blidum & Christensen, 1996; Knudsen eds., 1999;

Sanden & Frederiksen, 1997; Nielsen & Jensenius, 1996). In this case, learning is considered a result of the interaction in the group. The groups, and particularly the long-term groups, are also expected to serve as settings for the students to develop social and collaborative skills (Ibid.). Collaborative skills are considered a natural spin-off of group work but are nevertheless often the primary argument for applying group work to a study program. Correspondingly, the student's social and collaborative skills can be considered a prerequisite for well-functioning group work.

Social and collaborative skills may thus to some extent be considered as both the means and the aims of group work in education: the means of successful group work and the result of the group work. In the following, I will discuss the consequences of this overlap of means and aims. This will be done by analyzing the results of a research project with a focus on group work as part of project studies. The discussion will be preceded by an examination of the intentions of group work as a teaching and learning method.

THE LEARNING THEORY OF THE GROUP

As mentioned above, group work in education was introduced on a larger scale in Denmark in the 1970s. At the time the learning theory behind group work was founded in the progressivism and pragmatism of John Dewey, among others, and in the cognitivist constructivism of Jean Piaget (Illeris, 1974, 1981). Dewey was celebrated for his slogan 'learning by doing', which encapsulates his theory of learning based on personal and practical (real-life) experiences (Dewey, 1963).

Piaget's learning theory contributed to the above by pointing to the importance of the student's own activity in the learning process. Thus, some didactics equated the principle of accommodation with learning in the project groups (Illeris, 1974, 1981; Nissen, 1970). However, the theories did not ignore the difficulties the students may experience in the process of cooperating though they emphasized the positive aspects of the groups: the students would 'teach each other' and the possibility of deep learning would increase through the group discussions (Illeris, 1974, 1981). While these theories were non-political, group work in education became an ideological issue in Denmark. In the 1970s, it was heavily intertwined with the Marxist movement and the ideology of cooperative egalitarianism (Christensen, 2013). Additionally, group psychology and small-group research contributed with theories to shed light on some of the processes in the groups, e.g. the importance of a task, group conflicts, groupthink, and group conformity (Ibid.).

Although Piaget's theory was appreciated because of its emphasis on the student's own activity, it soon proved insufficient in relation to groups, since it was missing the collective element. Hence, when the theories of the Marxist psychologist Lev Vygotsky were translated and presented to a larger public in the 1980s, the group pedagogy gained a firmer foundation. While Piaget focused on the individual's (intra-psychic) learning process, Vygotsky focused on the interpersonal processes.

Thus, he conceptualized learning as a process going on between two or more people, accentuating the importance of 'a more competent other' (Vygotsky, 1978). According to Vygotsky, collaboration is essential for learning. This is congruent with the principle of group work, which is why contemporary group pedagogy and other collaborative teaching methods often refer to the learning theory of Vygotsky (Qvortrup & Keiding, 2016: 167).

One of the aims of group work may be to support the student's deep learning and to help him or her develop communicative skills (Sanden & Frederiksen, 1997). Another aim may be to develop the student's collaborative and teamwork skills. The means are the formation of the groups, the group tasks, the discussions in the group, and the process of (good) cooperation. According to Vygotsky, communication (use of language) is crucial for learning and development (Vygotsky, 1978).

Vygotsky is often criticized for underestimating the possibility of conflicts in groups. This may also be claimed towards most current group pedagogy in Denmark. The theories of learning in groups do not focus on conflicts, but it is a fact that the students experience severe difficulties in the group process (Gregersen & Mikkelsen, 2007; Nielsen, 2004; Christensen, 2013, 2016). It may therefore be pertinent to ask whether the intended means and aims of group work are congruent with the realities in the students' groups? In the following, we will have a closer look at the realities in group work situations from a student's perspective. But first, an outline of the intended means and aims.

MEANS OF GROUP WORK: STRUCTURE, FORMATION AND TASK

For the teacher, there seem to be certain topics concerning group work as a teaching and learning method that must be taken into consideration. In the following, these will be discussed as a *means* of group work, including (1) the formation of the groups; (2) the size of the groups; (3) the duration of the group work (short- or long-term); (4) the structure of the work process; and (5) the product of the group (the group task).

First of all, the principle of group formation must be decided. This includes whether the groups should be formally or non-formally established (Malmquist et al., 1963). Formally established groups are formed by the teacher who decides on the group formation on the basis of certain criteria such as homogenous versus heterogeneous according to the student's gender, experience, academic skills and/ or expectations of the work process in the group. Formal group formation can also be carried out following a principle of randomisation. In non-formally established groups, the group formation is left to the students. In this case, friendships and popularity may play a crucial role, potentially leading to the exclusion of some students and a division of the groups into 'good' and 'bad' groups with very different outcomes of the working process. It is thus inadvisable to leave the group formation to the students themselves (Nielsen, 2004; Keldorff, 1997; Christensen, 2013, 2016).

Second, forming groups involves considering the size of the group. Groups in higher education usually consist of 2 to 8 students, and experience shows that groups of 3 to 5 members function most optimally in terms of teaching and learning (Ibid.). Short-term discussion groups in class may beneficially consist of two students who can enter a dialogue. A general rule might be that the shorter the duration of the group work, the smaller the group.

Third, groups need tools for structuring their work process. The need for a clear framework varies depending on the duration and scope of the group work as well as the size of the group. While long-term groups are quite dependent on a formal working structure, it is less important for short-term group work. Similarly, the larger the group, the more important it is that the members discuss their expectations of the group work and reach clear agreements within the group (Kolmos & Kofoed, 2002). Otherwise, the group will struggle to function optimally. The negotiation of expectations should include discussions of how to establish a sound discussion culture, as well as how often the group will meet, and how much the members are expected to work in between meetings. It is also important that the group members discuss whether all members have to be present at all meetings, whether decisions can be made if not all members are present, and which expectations the members have of the output of the group work.

While the short-term discussion groups are intended to have a limited outcome, the long-term project groups are designed to deliver a thesis within a certain deadline. In most cases, the students also have to defend the thesis at an oral exam. This obviously increases the pressure on the group and requires heightened focus on the work ethos of the group. However, the group task is important to structure the group's work process. The group identity is thus tightly connected to the task or main subject (Sjølund, 1969; Sanden & Frederiksen, 1997).

AIMS OF GROUP WORK: DEEP LEARNING, COMMUNICATIVE SKILLS AND CO-WORKABILITY

One of the reasons why group work is used in education is because students are expected to optimise their learning through discussions with fellow students in the groups: Explaining things to others promotes learning and broadens the perspective on what is learnt. It is also easier to eliminate possible misunderstandings through group discussions (Chiriac, 2003; Chiriac & Hempel, 2013). Thus, group work seems to contribute to what we call deep learning (Biggs, 2003), since it may inspire the students to invest more time and energy in their studies. At the same time, it may in fact reduce the study time (Simonsen & Ulriksen, 1999). The group also has a social function as it can increase the students' attachment to their fellow students and to the institution. Finally, the group work is believed to train the students to collaborate in teams, a competence which may be highly valued in their future profession (Ibid.).

While groups stimulate the students' own activity it may be difficult to control the learning output of the groups. Whereas the teacher is in charge in the lectures, the group discussions are to a great extent left to the students themselves. The learning

outcome of the group is also dependent on the social psychology of the group (Gregersen & Mikkelsen, 2007; Nielsen, 2004; Christensen, 2016; Keldorff, 1997). Group members influence each other, and some members are more likely to take charge than others, just as some group members will take on large workloads, while others are freeloaders. It is not necessarily the best students who control what is constructed as 'the truth' in a group. Hence, the teacher still has to control the quality of the output of the group discussions and the group work. The close teacher attention is important for the groups. Otherwise, it problems may arise as pointed out in the former mentioned research project (Christensen, 2013, 2015).

GROUP WORK AND PROJECT STUDIES FROM THE STUDENTS' PERSPECTIVE

The case mentioned in the following was culled from a research project examining groups as an element of Danish Project Studies (DPS). DPS is a variant of Problem Based Learning (PBL) and is applied as an element of university teaching and learning in Denmark (Christensen, 2013).[2] Although DPS resemble PBL in many ways, there are certain differences that have to be taken into account.[3] To complicate matters further, there seem to be different ways of handling project studies at the different Danish educational institutions, just as there are different ways of handling DPS. The most commonly applied model is the one introduced at Roskilde University in the early 1970s. A slightly modified version of this model is now widely used across the Danish education system from primary school to university. It is also the model used by the two university programs I examined in the research project (Christensen, 2013).

DPS involves six elements: (1) problem orientation: the topic must be a 'real' problem for somebody/a group of people in the 'real world', not just a theoretical discussion; (2) project orientation: the output must be presented in the form of a project (usually a written report); (3) participant management: the students themselves are responsible for the work process; (4) exemplary learning: the topic must be exemplary in order for students to gain an insight into a broader complex of problems/theory; (5) interdisciplinary learning: the project must involve theory and methods from several disciplines; and (6) group work: the project is supposed to be carried out in a group that works together as 'a real group', i.e., a thoroughly collective working process (Kristensen, 1995: 24; Jæger, 2002; Christensen, 2013: 11). As may be apparent, DPS is more focused on the students' collective work processes than standard PBL. It also emphasizes the development of collaborative skills, which are considered a natural spin-off effect. Additionally, DPS students are left with an expanded sense of responsibility for the group process. Thus, the students are much more autonomous in DPS than they are expected to be in standard PLB.

At the two university programs I studied, DPS are conducted in groups formed by the students themselves on the basis of either choice of topic or personal choice of fellow group members, or both. The group formation process is coordinated and arranged by the students themselves. The group work may not be mandatory, but the

students are provided little or no supervision if they choose to work on their project alone, or if they are unable to find a group. From the outset, the groups are formally leaderless, leadership ideally shared in the groups. This is very hard in practice, not least because the students are provided with no or only vague tools on how to coordinate the group work and the group dynamics. In other words, the students are not properly instructed on how to work in a group, nor about the advantages and pitfalls of group work.

Since DPS and group work were introduced on a large scale in the Danish education system in the 1970s, group work has attained a mythical status as a pedagogical method capable of educating students to act as moral human beings (Illeris, 1974; Illeris, 1981; Rogers, 1970). The groups were supposed to teach students co-working skills, responsibility, and tolerance (Ibid.). These assumptions are still an integral part of the myth about groups and group work, not least when the group work is an element of project studies (Christensen, 2013).

My own research did not support this myth but rather showed that that the emphasis on group work generated a certain culture among the students that was far from tolerant. On the contrary, the students seemed preoccupied with positioning themselves as legitimate and competent, often at the expense of their fellow students. As a student explained in an interview, '[…] there is this social pressure on you, because it means so much which role you get. So when we sit in the auditorium in this big group, (whispering) no one dares to say anything...' (Student interview; own translation).

The emphasis on group work thus created a forum where the students invested a lot of effort in positioning themselves and their fellow students, maybe even more effort than they spent on the intended purpose of the project. The results from my research project revealed that the aims of group work, i.e. deep learning and development of communicative, collaborative and teamwork skills, were not necessarily achieved through the process. Hence, the myth that group work is the perfect arena for learning to collaborate in an egalitarian manner does not seem to match the students' experiences. On the contrary, it appears that group work may in fact foster exclusion of fellow students and non-inclusive working-patterns that contradict learning. The demands of group work should therefore be taken seriously and the aims, means and methods given more careful attention.

CONCLUSION: MORE ATTENTIVENESS TO THE MEANS OF GROUP WORK

The results from the research project show that the students' experiences in the groups diverge from the intended aims of group work: deep learning, development of communication skills and co-workability. Instead, the students invested a lot of effort in positioning themselves as attractive group partners and avoiding positions as potential problem members. This may be interpreted as a result of the students' frustrations with group work: the work processes are not running smoothly, and the groups are suffering from internal conflicts (Christensen, 2013, 2016; see also Nielsen, 2004; Keldorff, 1997; Gregersen & Mikkelsen, 2007).

Increasing the teacher's involvement in the formation of the groups would be fairly easy, while influencing the group's work process would be much more complicated and demanding. One solution could be to instruct the students on how to create a constructive discussion culture in the groups, e.g. a discussion culture that gives all the students equal opportunities to contribute to the group work.

Some students are more talkative and dominant than others, and it is important that also the more quiet ones are heard in group discussions. According to the learning theory of Vygotsky, people learn through language and the help from 'a more competent other' (Vygotsky, 1978). This supports the idea of forming heterogeneous groups and encouraging the students to listen to each other. 'Speaking rounds' may promote this kind of culture as they give all group members the same amount of time to express and discuss their views. It is important that this is done in an atmosphere of respect although there may be disagreement among the members and consensus has to be reached (Wiberg, 2013). Speaking rounds also support the aim of developing communicative skills.

One of the main problems of group work in a learning context is how to coordinate the work process in a formally leaderless group, i.e. groups that are formed without appointment of a leader. In a learning context, all group members are intended to be equal. Absence of a formal hierarchy may lead to the power struggles identified in the research project. Learning to work in teams and groups also includes learning leadership. This could be promoted by encouraging the students in the groups to take turns in 'being the leader'. In this case, 'leadership' could involve being responsible for group meetings, including sending out the agenda to the other group members, and functioning as the chairman during the discussions. Since the group members take turns as 'leader', each member gets to try this role and experience the work and respect attached to it (Hvenegaard et al., 2003; Christensen 2015).

In teams as well as in study groups, collective work will often be combined with individual work or work in smaller groups. Working in pairs makes it possible to optimize the benefits of group work, e.g. by having someone to discuss with during the work process while preparing for the meeting in the large group. This division into smaller groups may be a fruitful solution for group work aiming to achieve deep learning.

Regardless of whether the group agree on the collaboration process and manages to structure this and the meetings reasonably well, it is not always possible to avoid conflicts. Conflicts can arise for many reasons. Conflicts in study groups can be divided fairly roughly into academic and personal conflicts. Academic conflicts are rooted in different views of the content, whereas personal conflicts are related to interpersonal relations. While personal conflicts may be disruptive for the group, academic disagreement may be turned into something valuable. Although consensus may be pleasant, it rarely produces the best results or the most effective learning. Discussions that allow for disagreement and individual contributions are a much better way to achieve results and learning (Olsen & Pedersen, 1997).

Regardless of the conflicts, the study group is often a comfortable forum for discussion of topics, including topics not relevant to the group's task. This is an important aspect of group work that can contribute to the students' attachment to the institution and thus contribute to a generally better learning environment. However, the study groups require attention form the institution/teacher/supervisor to encourage the group to create a proper culture.

NOTES

[1] I would like to thank Professor Klaus Nielsen, Aarhus University and an anonymous reviewer for thorough and useful comments to a former version of this paper.

[2] The research project was a multi-methodological study and the data is illustrated in the table below:

Collected data	
Observations	More than 30 hours in two groups
Qualitative questionnaire	62 answers (answer percentage above 70)
Group interview	Group interview with 7 students
Individual interviews	Interview with 6 students and 4 teachers
Texts	Evaluation and research reports and texts from the two programs (presentations etc.)

[3] The differences between Problem Based Learning (PBL) and Danish Project Studies (DPS) is illustrated in this table, which is published in Christensen (2013):

	PBL	*DPS*
The structure of the work process	Individual studies, occasionally meetings in the group	Group work, occasionally replaced by individual studies defined by the group
	The supervisor is present at all/most group meetings	The supervisor is only present at certain group meetings
	The supervisor defines/describes the topic for the project study	The group defines/describes the topic for the project study
	The supervisor facilitates the discussions in the group	The group is responsible for facilitating the group discussions
Group size	Most commonly 8–10 students	Most commonly 4–6 students
The purpose with the group	Discussion group	Work group
	Emphasis on the student's individual learning process	Emphasis on the groups' shared product and the students' development of collaborative skills

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8. FORMATIVE REFORMULATIONS IN INTERVENTIONS ON SCHOOL DEVELOPMENT

A Longitudinal Case Study of a Project on Student Note-Writing

INTRODUCTION

This article analyses microprocesses within an intervention project at a Danish upper secondary school (the AK project, AK is an acronym for the school), which aims to develop teachers' understanding of student notes and subsequently their way of dealing with them in their teaching practice. The focus in the study is how the teachers formulate and reformulate the project ideas. These formulations and reformulations are assumed to be caused by the teachers' experience of contradictions between new ideas and established practices, attempts to make sense of the new ideas, resistance, misunderstandings etc. By using ethnographic methods, we analyse teacher reflections, understandings and development of aims and means. By applying activity theory as an analytical framework, reformulations or formative reformulations, Yrjö Engeström (2011), are interpreted as the dynamic and creative force in the project. They function as drivers of change and what he calls expansive learning and concept formation. Reformulations become visible by studying answers to interventions with regard to objects that are central to the activity of internal actors, such as teachers' answers to interventions with regard to student notes. However, interventions can be ambiguous, which is also the case in the AK project. A simultaneous introduction of an electronic OneNote platform for teacher-student communication and student note-writing threatened to dilute the AK project, because reformulations temporarily focused more on OneNote than student notes.

THE STUDENT NOTE PROJECT

The AK project ran from 2015 to 2017[1] and was conducted in two phases. In the first year, it encompassed one school leader (who held an observant, but retracted position throughout the project, took care of catering, deadlines etc. and pushed the process forward when threatening to stall) and four experienced teachers (one female and three males), representing a variety of subjects covering science, social science and the humanities. Along with ten other Danish upper secondary schools, they were part of a national intervention project on school writing led by my research team.[2] It was organised as a network and each school was assigned a

writing researcher for support in conducting research into student writing at their own school. Across the year, the network organised four thematic seminars on research methodology and writing research, and schools were teamed up in pairs for discussions about research designs and results. The intervention was restricted to teachers' research in order to gain insight for an intervention the following year. The AK teachers chose to focus on student notes. In the following year, they invited colleagues to participate in an intervention that aimed to study and eventually change teaching practice. My role during both years was to provide knowledge on research methodology and writing research, and feedback based on my observations in the AK project.

In phase two, experiences were shared with a group of seven AK teachers (also covering a range of subjects) who accepted the invitation, which brought the number of participants up to thirteen (including the school leader) out of a total of 114 teachers and leaders. The initial participants acted as project managers. The purpose was two-fold; primarily to give the newly joining colleagues the insight into student note-writing that the initial participants had already gained, but also to introduce the OneNote online platform. This second purpose was not an integral part of the AK project from the outset, but part of the school's ICT strategy, which was accentuated in the project. It seemed obvious to introduce the platform, probably because it offered new and promising facilities for student note-writing and for teacher-student communication. Year two was organised around four joint sessions. The first three are included in this analysis. In the sessions, the project managers opened for discussion themes that were relevant to the project, for instance how to observe note-writing, how to work with the OneNote platform, and not least the ideas behind the project. Another important activity, especially important to this analysis, was rounds among the participants, who then shared their experiences and understandings of the project. In between the sessions, the participants introduced the OneNote online platform to their classes and observed and discussed student notes in pairs.

RESEARCH INTEREST

The overarching research interest is the dynamics of change within the two-year project on note-writing. I try to capture the development dynamics by a study of the teacher's formulations and formative reformulations of aims and means expressed in the project. The intervention aimed to change two objects, student note-writing and teacher-student communication. The first was explicitly formulated by the project, while the second in a way sneaked into the project via the OneNote online platform, and was not explicitly formulated in the project, but the analysis indicates that it came on board as a blind passenger.

The research questions are: How do the initial project group formulate the AK project? How do participants reformulate the AK project in year two? What impact on the objects for change do the formative reformulations produce?

THEORY OF CHANGE

The AK project is an intervention that in the long run intends to change and to foster development of the way teachers deal with student notes. It is not a linear intervention, or a design intervention setting up specific goals and mile-stones, and it is not designed to spread to the entire school, at least not at first. It has the backing and participation of school management, but nevertheless it's thought to evolve bottom up. Therefore, it would be a simplification to speak of the intervention as a process of implementing something. We need a theory of change that is sensitive towards the dynamics which unfolds as formative processes among the participants, to be able to analyse the project. Below I briefly outline such a theory, which provides an understanding of the formative processes at a micro level of organisations. The formative processes of interest in the AK project are the teachers' formulations and reformulations of perceptions of student notes (the primary object of change) and new forms of communication between teachers and students via the OneNote online platform (the secondary object of change). These formulations and reformulations are, as already mentioned, assumed to be caused by teachers' experiences of contradictions and tensions between new ideas and established practices and they are understood as the drivers behind creativity and change, not as obstacles to be dealt with. "Contradictions manifest themselves in disturbances and innovative solutions" (Engeström, 2011: 609).

In his article "From design experiments to formative interventions" Engeström argues that design researchers in education, and he refers to Brown (1992) and Collins (1992), built on a tacit assumption of linearity, "that researchers make the grand design, teachers implement it (and contribute to its modification), and students learn better as a result" (Engeström, 2011: 600). He argues that design research is rooted in what he describes as 'the gold standard'-thinking in educational research, which emphasizes the importance of randomized controlled trials and derives its rationale from scientific experiments, where it is possible to control the various variables and where the researcher in advance know what a successful outcome is, such as an increase in crop yields. Applied in educational research it corresponds to that the researchers in advance know what they want to implement, and the "task of research is to check whether or not the desired outcomes are actually achieved" (p. 599). Even advanced design projects applying cyclic iterations is criticized for not basically challenging the linear understanding of change. Engeström quotes Middleton et al. (2008) for saying that "design experiments are valuable methodological additions to the standard procedures that already include randomised controlled trials and other traditional experimental studies" (p. 601). The basic critique is that in research of human behaviour you cannot control the variables (people and their activities), you need to study how they act and react. This involves attention to 'struggle', 'strategy', 'power' and 'position'. "In other words, interventions in human beings' activities are met with actors with identities and agency, not with anonymous mechanical responses" (p. 603).

Together with colleagues I analysed a project about innovation in school (Christensen et al., 2011a, 2011b, 2012). The project was initiated from outside and was based on ideas of innovation that were contrary to ideas prevailing in the schools, and it produced resistance and reformulations, or as we termed it, recontextualizations. These reformulations changed the initial idea, but also produced new ideas. However, not in a linear and peaceful process. And even though the initial idea didn't point to specific changes, it carried an idea of implementation which was contrary to the bottom-up process, the project also was seeking to promote. The project thus sat up success criteria (mile stones) for the implementation process. One can argue that it is necessary to do that if you put forward an idea of change. You need to explain what you want to implement and how you want to do it. However, the activity theory, according to Engeström, rejects the idea of implementing an idea. Instead, the idea along the way runs through a series of formative reformulations, which change the idea itself, but also brings it forward in altered forms.

Change produced as a series of reformulations is also analysed by Karen Borgnakke (1996) in a thorough study of the introduction of project work at a Danish university. Borgnakke speaks of communication and recommunication (corresponding to reformulations) of the idea at every level of the organisation. Reformulations happens for many reasons, one obvious is linguistic. Every knowledge domain or activity system, for instance a school subject, has its own specialized language (Shanahan & Shanahan, 2008, 2012). An intervention-idea is perhaps born in a scientific domain using scientific terminology. Following the argument of Borgnakke, it need to be reformulated in curriculum-terminology when 'transferred' to schools, because that's the meaningful terminology in that context. When 'transferred' to subjects it need to be formulated in subject-specific terminology. When 'transferred' into teacher practices, it need reformulations again to give meaning to different classrooms etc. The result is that the idea as such is never implemented, but also, that the idea initiates organisational development at many levels, and the success of a project should not be judged on its fulfilment as intended, but on its ability to initiate and inspire positive and constructive formative reformulations of the original idea.

METHODOLOGY OF INVESTIGATING CHANGE

Engeström (2011) suggests that the analysis of interventions should have activity systems (see below) as the unit of analysis, should see contradictions as a source of change and development, should see agency as a layer of causality (layers referring to the actors' interpretations, experienced contradictions and intentions) and should understand the transformation of practice as a form of expansive learning or concept formation. According to Engeström, formative reformulations are results of clashes between an intervention and complex activity systems having their own purposes, intentions, identity, symbols and artefacts – for instance various school subjects, school management, building maintenance and canteen services to mention a few.

Activity systems can be described as collective subjects using mediating tools/instruments to produce a meaningful object. In a school subject, the teachers use text books, specialised language, dialogues, methods etc. to produce student learning. Without the object, student learning, the activity has no meaning. It is a point that agency takes place within and between activity systems, and not just between individual actors.

An intervention that targets the object (student learning) must be expected to lead to reformulations or agency, because it activates the contradictions and structural tensions within and between activity systems dealing with the object. In the AK project, the primary object is student notes, and the secondary object is teacher-student communication, and it is therefore the understanding of these objects that are subject to formative reformulations and expansive learning or concept formation and eventually to organisational change.

To gain knowledge of student note-writing in practice, the AK teachers conducted observations in classrooms, and they were seeking to describe what they saw, rather than to assess quality. In an interview, one of the teachers emphasised that being trained to assess students makes it difficult to conduct descriptive observations, but especially the concept 'writing event' (an event in school that comprises some kind of writing activity, for instance 'students writing notes during a classroom discussion') helped to focus observations. The observation category was further narrowed down to 'note events', and what they focused on within note events were student 'note practices', for instance 'student repeatedly copying the teacher's blackboard', 'students repeatedly writing notes in group discussion' etc. (Krogh, 2015). There was no systematised focus on the teacher-student communication, since it was not yet recognised as being an object for change. The teachers made their observations in a colleague's classroom and discussed these observations together with the colleague.

The interview method 'talk around text' was applied and worked well. The idea of 'talk around text' is that a text, in this case a student note, is placed on the table or on the screen between the interviewer and the student, and that the interview is a student-teacher dialogue about that text (Krogh, 2015: 49; Lillis, 2008).

EMERGING INSIGHT IN STUDENT NOTE-WRITING

The focus on student notes was not motivated theoretically from the outset. In an interview, the teachers stated that it simply seemed to be an affordable and well-defined task within the overall theme, student writing, of the national project that they were part of. But along the way it became theoretically motivated, and at the start of phase two, a theoretical basis was emerging. Important findings from national and international research gradually became part of the knowledge base, which is an important change in itself. This went hand in hand with empirical findings from classroom observations and student interviews. This emerging knowledge base is summarised below.

Kobayashi (2005) concludes on a meta-study of 57 studies that note-writing is one of the most widely used study activities in teaching situations and note-writing generally has a positive but modest effect on learning. The AK-teachers' empirical studies showed that note-writing also at AK is a widely-used study activity.

Research shows that conventional (self-directed) note-writing leads to fewer and less coherent notes, which support the students' ability to remember the substance they have been taught to a lesser extent than teacher-directed note-writing (Kiewra et al., 1995). In another study, Kiewra et al. (1991) demonstrate that a reflectively-directed scaffolding, a review of the individual's own notes from a lesson or a review of notes written by peers or the teacher, is important for the effect. A Spanish study (Castello et al., 2005) supports these findings. An Australian study (Wellington & Osborne, 2001) proposes several types of student note-writing scaffolding, so that students do not just copy the teacher's blackboard. Several studies focus on note-writing as a tool for organising and maintaining academic material and/or a tool to approach content and subject discourse (Teng, 2011; Castelló et al., 2005; Badger et al., 2001; Harklau, 2001). The AK project did not produce any findings on teacher structuring of student notes, but it was up for discussion and a subject for teachers' interest, as the organisation and structuring of knowledge was the subject of many discussions.

Research also shows that transition from a lower to a higher educational level is important for students to start writing notes (Harclau, 2001; Christensen, 2016b). Note-writing is one of the ways that newcomers can demonstrate a serious attitude towards their new education and identify with the new cultural context that confronts them. The AK study did not produce any evidence on this, but as in the case of structuring notes, it was the subject of discussions.

Studies of an 8th grade science class in Finland (Danielsson, 2010) and a 10th grade science class in Norway (Lykknes & Smidt, 2010) show that student notes are largely copies of the teacher's blackboard. Lykknes and Smidt regard this to be positive for the students' learning process, because it is a re-contextualisation process, where texts (on the teacher's blackboard) are put into a new context (the students' note booklets), and their analyses show that an important selection process takes place in the re-contextualisation process. The terms note-taking and note-making are closely related to this point. They are based on Gunther Kress, who argues that we always create language when we use it (Kress, 1997; Bakhtin, 1996). The basic assumption is that there is always a creative aspect to note-writing, also in the case of copy-paste. Applied to the study of student notes, it means that we must always look for the making element, modest as it may be.

Student notes can be understood as student texts without explicit prompts and can be regarded as in-texts (Liberg, 2008) or an expression of self-communication (Berge & Herzberg, 2005). The two concepts characterise a frequently-occurring feature of student notes, namely that they are not intended for anyone other than the authors themselves to read. Sometimes teachers and peers are readers anyway, and this violates this note privacy. This point was the subject of considerable attention in the project.

The term 'self-hood', inspired by Roz Ivanič (1998), was adopted by the project. Ivanič talks about possibility for self-hood as a space available for a writer to try out his or her identity – what Ivanič calls the discoursal self. The point is that there needs to be a space for the students' personal positioning, unfolding and exploration in their writing tasks, and if this space is limited, the possibility for self-hood is also limited, which is considered harmful to the students' development as writers and learners.

Another important finding was that teachers in some subjects, for instance history, thought of their subject as purely oral. But the focus on student note-writing caused a perspective on the written aspects of the subject, which in turn slightly changed the understanding of the subject (cf. Shanahan & Shanahan above).

Table 1 from my own research (Christensen, 2016b) also played a central role in forming the analytical perspective of the AK project.

Table 1. Model for analysis of student notes

Purpose of note-writing	*Organising and storing knowledge*	*Developing knowledge*	*Identifying with or distance from the subject*
Notes as synchronic communication (timescale of the writing event)	To remember, describe and organise and structure the substance.	To decode, to (re)formulate, to reflect, to understand	Positioning socially in classroom and in relation to texts
Notes as diachronic communication (timescale of schooling, of life history and of subject discourse)	Connecting to existing knowledge (backward in time) Applying knowledge (forward in time)	Connecting to specialist language (backward in time) Applying subject discourse language (forward in time)	Identifying as an upper secondary student. Identification with disciplinary academic communities (imagined worlds)

The purposes of student note-writing are listed in the top bar (inspired by the Writing Wheel Mode. Evensen, 2010; Skrivesenteret, 2013). The left column divides the purposes into synchronic and diachronic functions (Bakhtin inspired via Ajagán-Lester et al., 2003). For instance, the fact that copying the teacher's blackboard not only helps the student to remember and structure the substance, but it also connects the student to academic language and knowledge with a long history. This provides yet another argument for letting the students copy.

SUMMARY OF THE PROJECT IDEAS EMERGING FROM YEAR ONE

In part, the project idea for year two was to replicate the success of conducting descriptive observations of student note practices and to let these observations be

subject to discussions between the teachers, but in part it was also to introduce the OneNote online platform for student note-writing and for teacher-student communication. Underlying this was a set of ideas that were not completely coherent, summarised in the table below.

The summary is regarded as an answer to the first research question: How does the initial project group formulate the AK project?

Table 2. Summary of emergent ideas

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1. Student note-writing is one of the most widely used study activities that has some positive influence on students' learning outcomes

2. There is not one right way to deal with student note-writing in the various subjects and classrooms

3. Teachers' increased knowledge of and insight into student note-writing will lead them to new ways of working with student notes in class

4. Teachers gain this insight by observing student note-writing in a colleague's classroom and then discussing these observations with the colleague afterwards

5. The purposes of student note-writing can be divided into three main types
(1) organising and storing knowledge, (2) developing knowledge and (3) identifying with or distance from subject knowledge

6. Teachers must be careful not to take over the student note-writing, because this violates the notes' character of being in-texts and restricts the students' possibility for self-hood

7. To some extent it will be useful to have a teacher-initiated structuring of student note-writing

8. OneNote online platform is a tool that facilitates both student note-writing and the teacher-student communication about note-writing. Neutral towards note-writing or not?

FORMATIVE REFORMULATIONS AT PROJECT SESSIONS IN YEAR TWO

In year two, the project managers introduced the project by saying: "How can we strengthen the student note-writing by using OneNote, without removing the opportunity for self-hood in their notes?" (31.08.16). The statement clearly addresses the primary object for change, student note-writing, and it touches upon the secondary object by addressing OneNote, not as an object for change, but rather as a potential threat to the primary object. That is why I say that an important consequence of the introduction of the OneNote online platform, changes in teacher-student communication, comes on board the project as a blind passenger. Under the headline Didactical challenges, the project managers addressed the technical problem: "The structure of OneNote has been a little difficult to understand for some participants." and "Some of the participants … have worked with a particular note technique, and it gives some problems to transform it into OneNote" (31.08.16). As we shall see, this

Table 3. New participants' reformulations at the sessions (31.08.16) and (25.10.16)

Participants' subjects	In line with project ideas	Reformulations – first session	Reformulations – second session
1. History	Aware of the self-hood-problem	1. Transfer existing note system from Word to OneNote 2. Huge technical challenge	1. Transfer existing note system from Word to OneNote 2. OneNote as 'surveillance'.
2. Science and music	None	1. OneNote structures and assembles students' written work 2. Minor technical challenges	1. OneNote structures written work 2. Teacher writes on the OneNote platform and shares with students
3. Maths	None	1. OneNote unifies the many platforms that students use 2. Assemble students' written work in a portfolio 3. OneNote used for students' reflection on learning	1. Try things out in OneNote to see what it can do
4. English	OneNote is a way for students to structure and organise notes	1. Assemble students' written work in a portfolio 2. Minor technical challenges	1. Minor technical challenges
5. History	None	1. OneNote is the platform for materials 2. OneNote is a collective note book for the class 3. Teacher highlights texts online in class	1. OneNote is the platform for materials 2. OneNote is a collective note book for the class 3. Teacher highlights texts online in class
6. Geography	None	1. OneNote is the new blackboard	1. OneNote is the new blackboard 2. Students copy-paste into OneNote
7. Science and maths	None	1. OneNote is the new blackboard	1. OneNote is the new blackboard 2. OneNote used for the collection of data 3. Let the students write notes with mathematical signs on paper

technical problem threatens to overshadow the primary object, student note-writing, and is more connected to the secondary object, teacher-student communication. However, it leads to a temporarily-revised aim, which is to get the participants started with OneNote, and a temporarily-revised means, which is to support them in doing so. This was probably unavoidable, but the result still is that the project takes a different direction than planned, at least temporarily.

At the session round, participants expressed themselves about the project. And these expressions are analysed as formative reformulations. By also focusing on what subjects the participants teach, I try to introduce activity systems in the analysis. This round was repeated at the second session. Below are abbreviations of participants' statements in the two rounds.

Only two of the new participants formulate ideas in line with the project idea. All new participants make reformulations of the project idea. The reformulations are about ways of using OneNote that in various ways address the secondary object, teacher-student communication: 'surveillance', 'share with students', 'new blackboard'. Most of the reformulations are based on the potential the participants see in the use of OneNote, and only one shows an interest in student-notes: 'collective notebook'.

All the initial participants express themselves in line with the project idea. However, one reformulation connected with teacher-student communication also appears: 'use student notes to create teacher-student relationships'.

The OneNote online platform has taken most of the attention. The technical issue is strongly present at the first session, but is already reduced at the second. The secondary object, teacher-student communication, then becomes apparent. Unfortunately, we do not have data to tell us to what degree subjects function as

Table 4. Initial participants' reformulations at the sessions (31.08.16) and (25.10.16)

Participants' subjects	In line with project ideas	Reformulations – first session	Reformulations – second session
8. Danish and religion	Teach students active reading, write in-texts (note-writing) in OneNote.	1. Technical challenges	1. Minor technical challenges
9. Danish and philosophy	Student note-writing without teacher interference. Organise notes. Read student notes in some cases	None	None
10. Social science and history	Read student notes in some cases	Use OneNote to create teacher-student relations	Digital Bildung (education)
11. Chemistry and maths	Student note-writing without teacher interference Don't read student notes	None	None

activity systems producing reformulations. I regard this as a first answer to the second research question: How do participants reformulate the AK project?

A DIFFERENT KIND OF REFORMULATION – REFLECTIVE INTERVIEWS

Three interviews were conducted on 12.10.16, between the two session rounds.

Nete is a history teacher and one of the new participants, number one in the register above. Nete expressed the same intention, as she did at both rounds, namely that she wanted to transfer the systematic structuring of student notes that she had already developed to OneNote. This would help her to keep a close eye on the student notes. When asked directly, she admitted that she read the student notes from time to time. Her purpose was not to control the students as such, but to find a way to involve silent students in class dialogue. "For example, I have asked [nn – a silent student] what she thinks about a certain question, they were asked to prepare at home … I know she has an answer… she puts her hand up by now." Thus, Nete's interest was to use student notes as a means for establishing communication with students she otherwise had difficulties to reach. In this respect, she combined the two objects for change, student notes and teacher-student communication.

Anna is a maths teacher, and a new participant, number three in the register above. What attracted Anna to the project was the OneNote platform. "I just think that now there was a new platform, and I thought that we should then try it out". Later she explained "… if I was … a student, I would wish that somebody would make a connection between what I am doing at home and what I am doing in school … so it all took place in a common space". And she confirmed that she had tried out the OneNote platform to see if it could be this common space. Already from the start, she thus had a purpose quite different from the project idea, but the connection between home and school is very much about teacher-student communication.

Anna admitted that the project had made her aware of student notes. "I think I have become more aware that students take notes" and continued "… but I will still say that I don't systematise it [note-writing] for every module … they should still be free to make their own notes, I believe, and their own system, and if they like to have them on paper, well, then they should have them on paper. … but I don't mind setting up a frame [on OneNote], and then sometimes say that they have to submit something in there … to force them onto the platform … but also to show them that maybe it has some possibilities to offer."

Anna also expressed an uncertainty about what can be considered a student note. Sometimes student notes in maths are like assignments the students have solved, and sometimes they write notes only to themselves. These last formulations are very much in line with the project idea, but Anna did not express them at the sessions. It showed that Anna was much more concerned with the project idea than her reformulations at the sessions revealed. It was also interesting that special circumstances in the maths subject influenced her view on student notes. Maths as an activity system was

crucial for her understanding of student notes and set constraints for the way she dealt with them in her teaching practice.

Line is a teacher in Danish and religion, and one of the initial participants. Line was not particularly aware of student notes before the project. "… as I remember, I related very little to student notes. I saw it much as the students' individual projects. And of course, I helped them structuring the notes by sometimes making worksheets they could write in… But …actually, I didn't give much attention to notes ,… and I believe I've had doubts about how important they [student notes] are, especially in Danish, because I believe … [the students] should be able to do something with texts, rather than to remember what we have done to some text in class, actually." And later she said "In religion it makes more sense to write notes to store knowledge, because it is more important to be able to remember some things." The subjects were clearly seen as activity systems here. Still, Line had changed her view on student notes in Danish. She had always striven to get students to read texts actively, by writing in them. And that was in fact a kind of note-writing, she admitted. "So, I think I have become more aware that for example to write notes in a text is something I have to teach them… So, I think that's new to me."

In the interviews, the teachers were given more time for reflection about their reformulations than in the sessions. In this reflective frame, they showed that they paid more attention to student notes than they showed in the context of the sessions. They dealt with student notes in new ways in their teaching practice. It indicates that although the reformulations, as they appeared in sessions, pointed in other directions than the project ideas, the teachers still had reformulations more in line with the basic project ideas, and that they were searching for new ways to deal with student notes. It is also noteworthy that none of the teachers spoke of technical problems in the interviews, although this was quite dominant in the sessions. It seems that reformulations existed on different layers, and that reformulations based on a reflective layer related more to the project's basic ideas than reformulations based on a project discussion. Of course, the participants were directly asked about the basic ideas in the interview, but they provided quite elaborate answers, pointing out actual changes in their teaching practice. They all addressed both objects, student notes and teacher-student communication. This adds to the answer to the second research question: How do participants reformulate the AK project? And, this holds an emerging answer to the third research question: What impact on the objects for change do the formative reformulations produce?

THE THIRD SESSION

An early draft of the above analysis was discussed with the project managers as part of their preparation for the third project session (08.02.17). At the session, they took up the focus on the primary object and succeeded in establishing a discussion of the key ideas of the AK project. For the first time, a reflected didactical discussion about student notes took place. It is too early to say what that will mean for the project in the future, but it is interesting to study the reformulations that took place at that

session. One reformulation that clearly stood out was that student notes had different forms and functions in the different subjects. Another was that having scruples about reading the student notes, and thus breaking their privacy, was gone. The point was discussed, and the experience was that first-year students, who had known the OneNote online platform from the start, accepted – and probably expected – that their notes were read by teachers. The general view among the participants was that students had already adjusted their note-writing to be addressed less to themselves and more to the teacher, or that the students would write their in-texts somewhere else.

This was partly confirmed in focus group interviews with students in two first-year classes, who were participating in the project. Asked whether there was something they refrained from writing because the teacher could read it, a girl promptly answered "No, I really don't. I just write in the language that I understand best, and use funny phrases from time to time". (Interview 1j, 11.11.16). The others agreed. Asked what they thought about the OneNote online platform, a student from another first-year class answered. "I'm a complete fan" (interview 1e, 18.11.16), and the rest agreed. Among year-two students, the opinions were more divided. This indicates that there is a change in note practice taking place. Maybe this is a sign of student note-writing developing into a new form and occupying new functions in teaching practice. If so, we have an interesting hypothesis as an answer to the third research question, about what impact the formative reformulations produce on the object. It seems that a new object is formed, combining the primary and secondary objects, student note-writing and teacher-student communication. The future will demonstrate this.

CONCLUSIONS

The analysis tells us a lot about formative reformulations within the project. It indicates that various reformulations by participants were based on their former experiences and the subjects they were teaching, i.e. the reformulations were derived from the activity systems. The reformulations were thus by no means out of touch with what was important, even if they went against the ideas of the project, and so they should not be considered a risk for the project as such. Furthermore, if we asked participants directly about the ideas of the project, they produced reformulations close to the project idea. It was as if we got access to an emergent understanding of the project, a creative layer or a formation of concepts, not yet mature for open formulations. An obvious interpretation could be that we are dealing with two layers of reformulations, a layer of immediate reformulations and a layer of reformulations reflected in close relation to the project idea and probably developing over a longer timespan than the immediate reformulations. The layer of immediate reformulations comprises the potential to change the project in many directions, and holds a real threat to the project, if it is not dealt with. The layer of reformulations in close relation to the project idea comprises the potential to develop the initial project ideas

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and create new ideas, and anchor them in the teachers' daily practice or activity systems.

NOTES

[1] The time of writing this article is February 2017 when the AK project has been nearly brought to an end.
[2] The research project Writing to Learn and Learning to Write (WLLW) funded by The Danish Council for Independent Research – http://www.sdu.dk/fos

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9. A LUHMANN-INSPIRED APPROACH TO INCLUDE NEUROSCIENTIFIC KNOWLEDGE CONCERNING ADOLESCENTS' MOTIVATION FOR LEARNING IN HIGH SCHOOL INSTRUCTION

INTRODUCTION

According to recent studies, high school education in Denmark is currently having a challenge to motivate students in classroom teaching (See Ågård, 2014; Hutters, Nielsen, & Görlich, 2013). The lack of motivation for learning in classroom teaching makes it difficult for students to achieve good learning outcomes and good study habits that would strengthen them in their future career. Based on these insights, it seems reasonable to assume that acquiring theoretical knowledge about motivation in adolescence may strengthen our understanding of motivational problems in a high school context, and may offer suggestions on how to deal with these problems. However, according to Krogh and Anderson (2013) theoretical knowledge concerning motivation for learning, which is dominated by psychological theories, is immense and difficult to navigate within. This chapter will present a systematic approach that allows for reflections on recent empirical knowledge about motivation for learning in adolescence without ignoring the existing theoretical knowledge.

Motivation is complex. It depends on the situational context, which is affected by values, experiences, self-assessment, and expectations. The planning and construction of instruction play a role for the motivation of the students. The teacher, in particular, plays a key role in affecting the motivation of the students (Skaalvik & Skaalvik, 2007). Affecting high school teachers' choice of instructional strategy in this way would be a sound approach to stimulate the motivation of high school students.

Several educational scholars argue that motivational problems may be considered in the light of the performance culture that characterises the educational system in many countries, as a consequence of an increased focus on tests and benchmarking (Biesta, 2014; Sørensen et al., 2013). This culture may increase competition among students, causing some to withdraw participation out of fear of embarrassment (Hutters & Lundbye, 2015). Research shows that extrinsic motivation, which is associated with aims rather than means in learning contexts, suppresses intrinsic motivation in many cases.[1] On a theoretical level, this may explain why an increased focus on tests has a negative impact on the motivation of high school students

(Krogh & Anderson, 2013). Thus, emphasising means rather than aims seems to be constructive when dealing with motivation for learning in a high school context.

A current research report states that social competition and the pressure for performing are among the most significant causes of stress among high school students in Denmark (Nielsen & Lagermann, 2017). Other empirical educational studies indicate that the relationship between the teacher and the student, and the relationships among students have a pronounced effect on a student's learning (see Danish Clearinghouse, 2008; Ågård, 2014; Nielsen, 2015). These empirical findings suggest that there is a connection between the social learning environment that takes place in a school context and motivation for learning among students. Both the opinions of other peers and the student-teacher relationship seem to play a significant role. Furthermore, Gotlieb et al., 2016, emphasise the positive influence of social-emotional imagination[2] on motivation for learning. This type of imagination seems to be linked to academic success and lifelong creative development,[3] and can be promoted by connecting new skills and information to a larger socially situated purpose and a rewarding image of the future. For instance, allowing the students to imagine how devotion to learning can lead to achievement of personal goals.

Lastly, the role of social skills in the learning process has been discussed and emphasised in several well-established learning theories. For instance, Vygotsky, 1978, states that social interactions precede the development of cognition. Deci and Ryan, 2000 argue that relatedness is one of three basic psychological needs that must be fulfilled in order to thrive, and, Bandura, 1977 suggests that people learn from one another, via observation, imitation and modelling.

This body of research provides strong scientific support for the connection between social aspects of learning environments and learning activities in a high school context, motivation for learning, and learning outcomes. Thus, an increased focus on social aspects concerning motivation for learning seems to be a productive way of approaching motivation for learning among high school students.

Below is a list of examples on the relevance of social skills for motivation for learning in scholastic contexts:

• In terms of teacher-student interaction, such as understanding and perceiving instructions as well as feedback (see for instance; Astington & Pelletier, 1996; Patanik, 2008; Ågård, 2014).
• In terms of student-student interactions (see for example Astington & Pelletier, 1996; Patanik, 2008) – such as group work, discussions and teaching-for-learning.

More indirectly:

• Promoting social-emotional imagination as described above (e.g. Gotlieb et al., 2016).
• Strengthening communicative skills, such as understanding the target group in terms of taking their perspective in order to tailor communication successfully (see Patnaik, 2008).

- Strengthening different analytical abilities: analysing and interpreting different characters/speakers that occur in different genres of literature/drama/visual expressions, and understanding different points of view (see Patnaik, 2008).

Social psychologists have long studied social behaviour, including those aspects that seem to be connected with motivation for learning. In social psychological terms, social behaviour involves social cognition. Social cognition encompasses all the cognitive processes that enable individuals to interact socially. This includes abilities such as mentalizing,[4] emotion recognition from both facial recognition and body posture cues, and empathy (Taylor et al., 2015; Burnett et al., 2010). Socio-emotional aspects are furthermore highly relevant for learning in a scholastic context as already stated. A number of researchers have more recently been exploring the relationship between the brain and social behaviour for novel insights by applying neuroscientific approaches (see for instance Todorov, Fiske, & Prentice, 2011; Immordino-Yang, 2011) These insights may extend and/or change our understanding of social behaviour related to motivation for learning.

Neuroscience studies human behaviour on a different organisational level than psychology. Thus, studying phenomena linked to motivation for learning from this perspective may add nuance to the understanding of social behaviour related to motivation for learning. Such insights may support some psychological theories over others, which might make it easier to navigate within theoretical knowledge concerning psychological aspects of motivation for learning. Neuroscience can link behavioural outcomes to specific neurological mechanisms, which may help to better differentiate psychological constructs (Todorov, Fiske, & Prentice, 2011). This could make it more obvious how to deal with students' social behaviour in a learning environment, as the psychological concepts become better defined. Additionally, studies that explore correlations between brain maturation and social aspects related to motivation for learning may reveal whether or not relevant neuronal processes differ according to age. Such findings may indicate whether some theories regarding motivation for learning are more appropriate to use than others during high school years. Another important implication of applying neuroscience is the potential to shed light on the dynamic interaction between the genetic factors associated with social aspects of motivation for learning and the impact of the learning environment on brain structures and processes. Such insights could potentially allow teachers to select instructional strategies that take into account prerequisites for motivation for learning in adolescence and indicate whether or not certain instructional strategies have an impact on the biology of the learning individual.

Neuroscientific insights may inspire high school teachers in different ways:

1. Neuroscientific findings that support high school teachers in their choice of existing instruction strategies.
2. Neuroscientific findings that are contrary to relevant learning and/or instructional theories and that would guide high school teachers in how not to instruct.
3. Insights that may give rise to new instructional approaches in high school teaching.

As the following sections will show, including neuroscientific insights in teaching practice requires much more than finding a few examples of research studies that seem to provide evidence for the neuroscientific underpinnings of social behavior in late adolescence. The scope of this chapter is to present a theoretical framework, inspired by Luhmann's systems theory, that seeks to increase high school teachers' awareness about neuroscientific findings that shed light on social behaviour related to motivation for learning in adolescence. The overall research question that will be considered in this chapter is as follows:

"How can Luhmann's systems theory create a framework for communication between the research field that explores the neuroscientific underpinnings of social behaviour relevant for motivation for learning in adolescence and high school instruction?"[5]

CONCEPTIONS OF INCLUDING NEUROSCIENCE IN SCHOOL INSTRUCTION

Using neuroscience to inform and improve educational practice is the purpose of the research field termed educational neuroscience. Educational neuroscience is a relatively new research front, partly driven forward by a number of scholars who have claimed that teaching teachers about neuroscience will inspire better instruction (Bruer, 2016). Despite the optimism flourishing among certain groups of researchers, the last two decades have also been characterised by a growing scepticism about the prospects of bridging neuroscience and education (Bruer, 1997; Bowers, 2016).

A dominant notion is that the research fields of neuroscience and educational science should merge, in order to apply neuroscientific findings in a scholastic context successfully. This poses a significant challenge, however, as neuroscience and educational science have markedly different traditions for research (Schilhab & Steffensen, 2007), and communicate through different scientific publications and conferences (Bruer, 2016).

Another challenge concerns the communication between neuroscientists and educational scholars, as well as practicing educators. Understanding the knowledge-production of the research field seems to be necessary in order to consider potential practical applications of the findings. However, this is not trivial, as the research terminology might seem esoteric for practitioners and educational scholars (Schilhab & Steffensen, 2007). Additionally, studies examining the relationship between brain structure/function, for example, and behaviour often apply different approaches and methods (Ansari, 2012), complicating the picture of the existing knowledge further. Scholars have also been absorbed in issues concerning the challenge of generalising from findings, based on experiments using brain-imaging technology, because these studies are subject to a number of uncertainties and limitations. They argue that whenever interpretations of brain images lead to the articulation of correlations between brain structure, brain function, and behaviour, these findings should be interpreted with much caution (Ansari, 2012). Philosophers of science argue that

bridging educational science and neuroscience is such a challenge that educational neuroscience might not stand much of a chance as a united research field in the near future (Clark, 2013; Schilhab & Steffensen, 2007).

According to Mariager (2008), Kuhn's theory of paradigms would support the notion that the fusion of educational science and neuroscience, both examples of paradigms, is too big of a challenge. Their epistemology, ontology, traditions and language are quite different, which makes these paradigms incommensurable. However, his theory does not suggest how to constructively improve communication and collaboration in this intersection with the aim of improving understanding of complex phenomena related to learning. One obvious reason is that Kuhn's theory of paradigms is based on studies about scientific cultures that were much more homogenous than most research fields are today (Mariager, 2008). The inter-disciplinary and cross-disciplinary nature of the intersection between the paradigms requires that experts with different scientific backgrounds collaborate and communicate with each other. Describing, understanding and improving the exchange of information between these domains therefore call for more modern theoretical views that embrace the complicated conditions of the intersection between not only neuroscience and educational science, but also teaching practice. Luhmann's systems theory offers another perspective on the interchange of knowledge between neuroscience and educational science and teaching practice that is different from merging the research fields involved in this intersection. According to this approach, knowledge that seems to inspire high school teachers' choice of instructional design can be viewed as being divided into separate systems, depending on their purpose, approaches and communicative features. This may allow a fruitful dialogue between those systems, the so-called didactic knowledge domains, which appear to affect high school teachers in their choice of instructional strategy. According to Luhmann's systems theory, the separation between systems, here exemplified as knowledge domains, is a prerequisite for communication between the systems. The next paragraphs will unfold this theoretical approach further, and elaborate on the above.

NEUROSCIENTIFIC INSIGHTS ABOUT SOCIAL BEHAVIOUR RELATED TO MOTIVATION FOR LEARNING IN A HIGH SCHOOL CONTEXT, UNDERSTOOD IN TERMS OF LUHMANN'S SYSTEM THEORY

Instructional aspects such as learning goals, teaching methods, choice of media and evaluation are important elements of a teacher's instructional strategy (Keiding & Qvortrup, 2014). In a Danish educational context, learning goals, teaching methods and content are not given, but are aspects that each teacher chooses to some extent (Qvortrup & Keiding, 2014). Inspired by Luhmann's systems theory, Rasmussen, Kruse and Holm (2007), and Keiding and Qvortrup (2014), have developed a theory stating that high school teachers' grounds for choosing certain instructional strategies fall into one or more of the following three categories, also referred to as didactic

knowledge domains; (1) knowledge based on pedagogic and didactic experience, (2) knowledge derived from pedagogic and didactic theories, and (3) knowledge derived from empirical educational science. The first category is defined as being a product of the instructional experience of the high school teacher. The second is defined as reflection programmes offered by learning theories and didactical theories, and the third is defined as empirical evidence conducted by educational science that may offer indications for the effectiveness of certain instructional strategies in a specific learning context. The PhD project that this chapter leans on suggests that knowledge about neuroscientific insights concerning social behavioural aspects related to motivation for learning may constitute a fourth knowledge domain that would serve as a point of orientation when choosing instruction strategy in a high school context.

To further grasp the relevance of systems theory in this context, it is essential to explain Luhmann's understanding of a system, his concept concerning functional differentiation, as well as his understanding of complexity. According to Luhmann, there is a distinction between the outside world and the system itself. The system is closed at the level of operation, but open at the level of observation and cognition, due to so-called structural couplings. This means that the systems can only affect and observe each other through communication (verbal as well as non-verbal). The scheme below shows the main elements of his social systems theory (Luhmann, 2000).

Figure 1. The main elements of Luhmann's social systems theory (Luhmann, 2000)

The educational system is one example of a social system, more specifically a societal system. High school as an institution is an example of another type of social system, an organisation, and the classroom instruction/learning environment exemplifies an interaction (Qvortrup, 2008). According to the scheme above, each of these social systems is ranked alongside each other, but are considered to be separate systems. Moreover, each social system consists of communication and operations that are autopoietic[6] (Luhmann, 2000, p. 53), and the social system is distinguished between the system itself and the outside world. In other words, the world is what the system constructs when it marks a difference.

Each societal system is characterised by being functionally differentiated, which means that each of the societal systems has a given *purpose* in society. For instance, the purpose of the scientific system is to deliver scientifically-proven insights to society. The purpose of the educational system is to educate and teach. The output of the scientific system is to produce knowledge that other social systems can use, whereas the output of the educational system is to educate and teach students in a way that makes them competent for the job market and society in general (Rasmussen, Kruse, & Holm, 2007, pp. 32–24).

In the same way, each of the didactic knowledge domains presented previously in this chapter has specific functions, as each of them constitutes a specific system. This understanding of societal systems makes it clear that each of them has a specific purpose that would be reflected in their operations and communications.

Communication is more specifically carried out by psychic systems, another type of system, which can connect or disconnect with specific communications within the societal system itself. Psychic systems act as representatives for a specific system (Luhmann, 2000). For instance, a researcher studying neuroscientific underpinnings of social aspects related to motivation for learning is considered to be a representative for this fourth didactic knowledge domain.

Luhmann's systems theory allows us to take into account the world's complexity. It states that communication is improbable and is challenged by the existence of double contingency.[7] According to Luhmann, this challenge can be dealt with through the simplifications of the system codes (Luhmann, 2000). For instance, the code of the scientific system is true/false (p. 33). In the same way, the code of the educational system is transferable/non-transferable (Rasmussen, Kruse, & Holm, 2007, pp. 33–34).

Didactical knowledge domain	Pedagogic and didactic experience	Pedagogic and didactic theories	Educational science	Research concerning correlations between neuronal processes and motivation for learning in adolescence
Code	Works/does not work	Guiding(instructive)/ non-guiding	True/false	True/false

The code of the knowledge domain of pedagogical experience about how teaching can/ought to be carried out is: works/does not work. The scheme above lists the binary codes of the remaining knowledge domains (Qvortrup & Keiding, 2014). These binary codes enable other systems to grasp the purpose of a specific system, which is vital in order to reduce the complexity of the outside world. This research project aims to describe the function of the research field concerned with brain maturation and motivation for learning. How this is put into effect will be described in the following sections.

To further elaborate on Luhmann's understanding of observations and complexity, we could use the PhD project that this chapter leans on as an example. As a representative for the educational science system, which is a system in the scientific system, the PhD project makes observations of the research field concerned with neuroscientific underpinnings of social aspects related to motivation for learning in adolescence.[8] According to Luhmann, this will allow for other types of observations than if a representative for the research field in question were to make the observations. Furthermore, knowledge created using this approach, as a product of observations and analyses, would have the potential to strengthen the educational system, allowing this system to reduce the complexity of the research field concerned with brain maturation and motivation for learning – from an educational viewpoint. According to Luhmann, cumulative knowledge, the goal of performing science, can be understood as expectation structures that strengthen a systems prediction of the outside world, in this case the prediction of the research field in question. Thereby, this reduces the system's perception of the complexity of the outside world, but increases the complexity of the system itself.

DESCRIBING THE KNOWLEDGE DOMAIN REQUIRES MAPPING THE RESEARCH FIELD INVOLVED IN TERMS OF ITS SYSTEMS AND COMMUNICATIONS

Including neuroscientific insights in a scholastic context is not without challenges, as previously mentioned. What in part appears to be crucial for a qualified inclusion is an understanding of the neuroscientific and psychological research that offers insights into this didactic knowledge domain. Such an understanding would enable teachers and educational researchers to be more selective and critical when encountering communications about these types of insight. According to Luhmann's approach, an understanding of a knowledge domain requires knowledge about its *function, output and self-reflection*. A scientific system's self-reflections is linked to its programmes, understood as scientific theories and methods that help define the system, which is an important step in the clarification of the difference between the system and the outside world (Rasmussen, Kruse, & Holm, 2008). Kuhn's theory of paradigms is useful in the sense that a number of concepts[9] applied to describe a paradigm collectively serve as systematic, descriptive tools that help map those systems which come into play in the research field, exploring neuronal underpinnings of social behaviour related to motivation for learning. Supported by Luhmann's emphasis on making distinctions between different systems, the PhD project that this chapter leans on aims to map the research field in question. The purpose is to create an overview that would guide educational scholars and practitioners in how to navigate in the scientific communication of findings produced in the research field.

INTRODUCING THE CHARACTERISTICS OF THE RESEARCH
FIELD FROM EN EDUCATIONAL VIEWPOINT

In order to make a well-defined mapping, it is important to select themes that are relevant for social aspects related to motivation for learning in a high school setting. From an educational viewpoint, it is of interest whether the brain's maturational state during high school years differs significantly from early adolescence and also from adulthood. If so, this might shed light on the prerequisites for social behaviour related to motivation for learning. Furthermore, insights into the impact of instructional strategies[10] on the brain structure and function might indicate whether or not certain learning situations are fruitful for high school students, in terms of their motivation for learning. First of all, this requires knowledge about the fundamental principles of brain maturational processes[11] in adolescence. It is vital to understand that the relationship between brain structure, brain function and behaviour is highly complex, and that current research indicates that many different regions in the brain cooperate in order to support behavioural outcomes. Thus, insights into the overall changes in brain maturation in adolescence seem necessary in order to understand the relationship between brain development and behaviour in high school years.

Second of all, identifying and examining brain regions and brain processes that are specific to social cognition and socio-emotional skills are important steps in order to describe and understand social aspects related to motivation for learning on different organisational levels. This is not a simple task, as the phenomena involved in social behaviour are intertwined. For instance, Gotlieb et al. (2016) argue that social cognition depends on social-emotional imagination, which seems to involve more brain regions than social cognition alone. Furthermore, social cognition is partly governed by and interacts with executive functions[12] (Fleischer, 2015).

Finally, it is central to determine how changes in social cognition and socio-emotional skills can be assessed on a neuronal level. This is important to uncover for the sake of showing how interventions, such as instructional strategies, might affect the developing brain of the late adolescent. An essential part of doing so is to determine how plastic[13] the brain is in late adolescence, and more specifically brain regions associated with social cognitive and socio-emotional skills.

The overall *function* of this didactic knowledge domain is to improve high school instruction, but if we take a closer look at research contributing insights to this knowledge domain, there seems to be more than one function according to the type of research being conducted. Some studies have the purpose of examining aspects that could prevent or treat children or adolescents with learning disabilities, thereby improving instruction in special education, while others focus on typically-developing children and aim to improve general education (see Bruer, 2016). Moreover, insights that are relevant for correlations between brain maturation and learning in terms of cognitive functions are also often derived from research projects

that seek to improve health conditions among children and adolescents, which could benefit the health system and/or the judicial system (Steinberg, 2010), as well as from research projects that have the characteristics of basic science, primarily benefiting the scientific system itself.

As pointed out, a system's *self-reflection* is linked to its programmes. Central to the knowledge domain explored here are studies that explore correlations between brain maturation and social behaviour related to motivation for learning. Brain maturation is a concept that covers a number of morphological[14] and physiological[15] changes that occur with time, which ensure that the brain matures to a point where it is adult-like. Brain maturation, however, is an ongoing and highly complex process, which is not identical with improvements in behaviour at all times. The relationship seems to fluctuate throughout development. In adolescence, brain maturation is being examined in terms of different brain tissue measurements,[16] interactions between pubertal hormones and brain maturation, changes in neurotransmitter circuits, especially the ones related to the reward system, and in terms of neuroplasticity (e.g. Arain et al., 2013; Jetha & Segalowitz, 2012; Steinberg, 2010). Most often the studies belonging to this research field are nomothetic and descriptive. They involve applying statistical methods and models to quantify and generalise from study samples, and seek to find correlations between brain maturational phenomena and behaviour. Whenever possible, causality is described. The goal is to create theories that can predict the relationship between neural processes such as those linked to brain maturation and behavior.[17]

In recent years, there has been a greater focus on longitudinal study designs in studies that explore brain maturation (Jernigan et al., 2013), as well as cultural approaches[18] that shed light on the role of culture on brain phenomena and vice versa. These longitudinal and cultural studies help unravel individual differences in brain development and behaviour. Moreover, research projects applying a multidisciplinary approach have become increasingly popular.

The research field draws on more basic disciplines like molecular biology and chemistry, as well as more interdisciplinary approaches such as radiology, programming and cognitive psychological approaches (see Table 1). These different approaches have specific epistemological views and methods, which are important to map and be aware of in order to understand the nature of knowledge production in this research field, and thus the quality and relevance of the research findings. Furthermore, each approach leans on a body of theories that have come to life by means of previous research. These theories often comprise assumptions that the hypotheses are built on, which explains why they are important to point out and understand in order to judge the quality and uses of the studies.

The following tables are tentative examples of how maps reflecting relevant system theoretical features of the research field may be constructed. Please note that every aspect described, such as epistemologies and theories, has not yet been included.

Table 2. Most common systems in the system (could be divided in other ways)
of the research field in question (still in the making)

Systems in the knowledge domain	Level of organisation	Disciplines/approaches
Neuroscientific approach	Brain, brain region, cell	Radiological techniques, imaging analysis Lesion studies Post-mortem studies Animal studies Histological approaches Electrophysiological approaches Biochemical approaches Statistical analysis
Heritability studies	Population, individual, gene	Twin studies (nature/nurture, neuroplasticity) Genetic approaches: such as GWA, GCT. Exploring the association between genotype and phenotype (nature/nurture, neuroplasticity) Statistical analysis
Cognitive approach	Individual	Neuroscientific disciplines Neuropsychological tests Interview Questionnaire Statistical analysis
Developmental cognitive approach	Individual	Cognitive approaches (behavioural, neuroscientific) that study trajectories in childhood, adolescence and adulthood. Statistical analysis
Social cognitive/ psychological approach	Population (cultural), group, individual in a social context	Studying behavioural, social, cultural aspects. (In a laboratory setting or in the field) Interview Questionnaire Statistical analysis
Social-affective neuroscientific approach	Population (cultural), group, individual in a social context	Neuroscientific methods Social psychological methods Affective methods Statistical analysis

MAPPING THE SCIENTIFIC COMMUNICATION OF THE RESEARCH FIELD

Observing and describing communication is a means to define the function, output and self-reflection of the research field in question. The scientific literature is one example of a medium where different types of communication take place, according to Luhmann's terminology. Distinguishing between different categories of scientific

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*Table 3. Most common approaches (could be divided in other ways) of
the research field in question (still in the making)*

Types of studies	Purpose	Other comments
Longitudinal	Relationship between brain development and/or behaviour and age over long periods of time. Individual differences and variances in trajectories, as well as similarities in trajectories within a group/ population	
Cross-sectional	To find similarities/differences in brain maturation and/or behaviour in a group of subjects at a certain age	
Morphological (anatomical/ structural)	Studying brain structure, often by means of MRI technology, (either module, ROI,[19] connectivity or whole brain measurements)	
Functional (physiological)	Studying brain activity either at rest or during a cognitive task. For instance, by means of BOLD response (fMRI), electrical waves (EEG), and/or magnetic field (MEG)	
Behavioural	Studying behavioural aspects without accounting for associated neuroscientific mechanisms	
Integrative/ multidisciplinary/cross-disciplinary approaches	Finding correlations between brain maturation, behaviour and also certain environmental factors. Often either cross-sectional or longitudinal	Examples: PLING study, ABCD[20] study
Intervention studies	Testing how a certain intervention affects behaviour and neuronal processes	Examples: MYRIAD[21]

literature clarifies the type of communication that we meet in this knowledge domain. To fully understand the quality[22] of knowledge production, it may be helpful to have an insight into the different categories of scientific literature that belong to a specific research field. These categories have the potential to strengthen the reader's ability to further understand the purpose of specific examples of scientific literature and the types of argument put forward in these texts. What has become clear so far is that scientific literature that presents or refers to findings in this research field can be divided into at least three categories:

1. Empirical studies. Studies that study one or more phenomena related to brain maturation and learning in adolescence. Typically (a) brain maturation studies

that study the morphology of the brain, (b) research studying the functionality of the brain in terms of BOLD response when at rest or during a behavioural task, (c) behavioural studies that study certain behavioural aspects such as mentalizing, (d) field studies that study the behaviour of individuals in a social context.

2. Meta-studies (review papers). Trying to find similarities and differences in a number of empirical studies concerning specific phenomena related to brain maturation and learning in adolescence. Aiming to make a description of the current status of the research field in question and pointing out ways to improve the current approaches. Quite often trying to outline the implications for other functional systems, in this case the educational system. For instance, the review papers of Arain et al. (2013), and Steinberg (2010).

3. Critical research. Reflections on methodical as well as philosophical issues concerning the field. Often in the form of papers in philosophical journals, commentaries in scientific journals, or sections in scientific literature belonging to category (a) or (b). For instance, discussing the issue concerning whether age is an appropriate parameter in developmental cognitive studies.

THE INTERDISCIPLINARY NATURE OF THE RESEARCH FIELD IN QUESTION IS REFLECTED IN COMMUNICATION

Quite often, researchers trained in specific approaches would spend time understanding the researchers with other scientific backgrounds, in order to articulate and test hypotheses that do not only address one level of organisation, but several levels. For instance, testing a hypothesis about the neurobiological underpinnings of social skills would require radiological approaches, typically in the form of fMRI, as well as more traditional psychological approaches in terms of, for example, neuropsychological testing. Furthermore, peer reviews of scientific publications concerning brain maturation and behaviour in adolescence require scientific insights into several of the methods involved in these types of study. An understanding of the quality of interdisciplinary communication of the research field associated with this fourth knowledge domain seems necessary in order to evaluate the status of the current knowledge about the neuroscientific underpinnings of motivation for learning.

To explore the inter-disciplinary and cross-disciplinary nature of communication, Harry Collins' distinction between Contributory Expertise and Interactional Expertise is useful. These concepts help identify and classify different types of communication being carried out in the research field, and have the potential to reveal whether the scientific communication was successful or not. Interactional expertise is one among several expertises that we can possess. In scientific societal contexts it is contrasted to contributory expertise, also referred to as full-blown expertise, which can be understood as an expertise that requires practical experience with a certain expertise. Interactional expertise is the medium of communication in peer review in science as exemplified above, in review committees and in interdisciplinary projects among other mediums, and it involves having some degree of understanding of the

subject matter, as well as being linguistically socialised. The concept of interactional expertise is supported by experiments that show that it is possible to acquire tacit knowledge of the language belonging to a specialist area, without acquiring the tacit knowledge of the practices belonging to that area (Collins et al., 2006). It follows that the quality of the research referred to here must draw on interactional expertise to some extent, in order to understand the correlations between phenomena related to motivation for learning on different organisational levels.

For example, at UCSD[23] a number of research projects track the brain maturation and different cognitive outputs. One of these research projects, the so-called PLING study, is being highlighted here for the sake of clarifying the interdisciplinary communication. The objective of the PLING study is to determine by means of MRI technology how much healthy children differ from each other in the rate at which their brains develop biologically, particularly in the connecting fibres that transmit information within the brain, and how closely this mirrors the pace of their mental development.[24] The research project is longitudinal and involves researchers from different systems. They study the morphology and the functional connectivity of the brain and try to find correlations with different cognitive functions. Weekly research meetings are being held in order to analyse and discuss the data, as well as to determine what papers to write in which scientific journals. What seems to be necessary in these types of collaboration is that some sort of translation takes place between the researchers with different scientific backgrounds, in order to understand the different scientific approaches, and, thereby, to be able to interpret data collectively. This type of translation can be understood in terms of 'Interactional Expertise', and from an educational point of view, it can be used as a marker for the quality of research, as it enables educators to get a sense of the quality of collaboration, which is crucial for research in this research field.[25]

COMMUNICATION BETWEEN THE RESEARCH FIELD IN QUESTION AND HIGH SCHOOL EDUCATION

The mapping of the suggested fourth didactic knowledge domain will ultimately highlight the domain's characteristics in terms of communicative features as described in the previous sections. This will allow for a comparison of differences between this didactic knowledge domain and other didactic knowledge domains that seem to affect high school teachers in their choice of instructional strategies.

It is important to recall that the binary code of the science system is different from the educational system, which implies that according to the system we represent, we have different assumptions about the world and view the world from different angles, which can make communication between systems very difficult. However, systems can relate to each other in terms of *structural coupling* (Luhmann, 1997, Chapter 1) without losing their independence. They can disturb each other by emphasising the difference between a system and its surroundings. This requires awareness about the differences between the systems, and the mapping of the fourth

didactic knowledge domain seeks to give rise to this awareness. A structural coupling can irritate a system to make selections, but not determine them. It cannot ensure that communication between systems proceeds in a coordinated manner, but it increases the possibility for a system to develop in such a way that it is being tolerated by the surrounding world (Rasmussen & Kruse, 2007). A mapping of the research field concerned with correlations between brain maturation and motivation for learning in adolescence would potentially disturb high school teachers to make some selections that are in agreement with findings from the research field in question. In accordance with the theoretical framework put forward here, communication between didactic knowledge domains and teaching practice has more than one direction. The knowledge domains of teachers' experience and knowledge, educational science, and learning theory/didactic theory, respectively, are capable of disturbing this fourth knowledge domain. Hence, this enables a dynamic dialogue between the four different knowledge domains.

RESEARCH FINDINGS REPRESENTING THE FOURTH DIDACTIC KNOWLEDGE DOMAIN

As stated in the introduction, neuronal underpinnings of social aspects related to motivation for learning could have the potential to expand the understanding of existing theories concerned with motivation for learning, as well as serve as a guidance in choosing instructional strategies that are consistent with these findings. These neuroscientific insights may pose relevant questions about high school instruction that could lead to improved motivation for learning among high school students.

Empirical evidence from educational studies, as well as learning theories presented in the introduction, which support the relationship between social skills and motivation for learning, do not take into account how the adolescent brain develops during high school years. Fortunately, there has been an almost explosive growth during the last decade in several of the scientific findings of those systems that seem to constitute the fourth didactic knowledge domain suggested here. Correlations between brain structure, brain function, and social behaviour in adolescence have been explored, and it has become clear that social behaviour is not merely a product of hormones and social environment, but is also affected by brain maturation (Dumontheil, 2015).

The following paragraphs will briefly elaborate on some of these main findings, as well as on possible connections to instructional strategies.

BRAIN MATURATION IN ADOLESCENCE

On a morphological/neuroanatomical level in adolescence, there is an overall reduction in different brain morphological measures, such as cortical[26] grey matter[27] volume, of global as well as local brain regions. There is an overall increase in

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white matter volume[28] in all cortical areas. The reduction of grey matter volume in the form of cortical thinning and cortical surface areas, as well as the increase of white matter volume throughout the cortex, are interpreted as signs of maturation, which are assumed, and in some cases proved, to correlate with the improvement in cognitive skills, according to more specific studies that focus on changes in cognitive skills during adolescence.[29] These brain maturational indicators have high heritability factors, implying that their development is largely controlled by genetic factors (see Brown et al., 2012). However, some intervention studies indicate that training/interventions affect the morphology of the brain to some extent (e.g. Knoll et al., 2016). In general, the impact of different training interventions is difficult to explain, as there is a lack of studies examining this aspect.

Moreover, studies show that structural brain connectivity, which is interpreted as the building blocks necessary for communication between brain regions, changes throughout adolescence. One study, for instance, shows that connectivity increases in late adolescence between frontal regions of the brain, regions that are associated with executive functions and some aspects of social cognition, and subcortical regions, such as the ones supporting emotional aspects of social skills. Connectivity between frontal regions and parietal regions also increases throughout adolescence. This could support the notion that adolescents become better at behavioural regulations as they age, because subcortical regions are responsible for the initiation of affective/ emotional and reward-seeking processes, and the strengthening of connectivity between frontal and parietal as well as subcortical regions may be involved in a top-down control of emotional processes (see for example Baker et al., 2015). On a physiological level, in terms of brain activity, different fMRI studies show that brain connectivity associated with cognitive functions seems to become more focused with age. This implies that brain networks associated with cognitive functions improve with time (Jetha & Segalowitz, 2012). However, more studies are needed to explore possible fluctuations within smaller age intervals.

Neuroscientific studies show that the reward system, as well as neurotransmission[30] associated with the neurotransmitters, dopamine and serotonin, in the prefrontal cortex, are still under development in adolescence (Crone & Dahl, 2012; Sturman & Moghaddam, 2011; Wahlstrom et al., 2011). In general, there is consistency about the relationship between dopamine and incentive behaviour,[31] in limbic regions in particular (Wahlstrom et al., 2011). Studies indicate that behavioural outcome depends on the brain region in which the dopamine level is high, as the following insights will explain.

Dopamine levels in PFC seem to be highest in adolescence (Wahlstrom et al., 2011). However, dopamine levels that are too high might weaken the function of PFC (O'Donnell, 2010), which could support observations indicating that adolescents seem on average to be less in control of emotional impulses than adults. Striatal-limbic regions[32] seem to be hyper-responsive during adolescence in terms of dopamine activity. This goes for social rewards as well as material rewards (Galvan, 2010), and possibly more significantly with positive rewards (Silverman et al., 2015). Exactly how

the reward system changes during development in adolescence is still unclear, due to the lack of studies integrating different biological organisational levels (Galvan, 2010).

BRAIN PHYSIOLOGICAL FINDINGS ABOUT SOCIAL COGNITIVE ASPECTS, SOCIAL-EMOTIONAL SKILLS AND SOCIAL REWARDS

Specific brain regions that are shown to support mentalizing functions, executive functions and social-emotional abilities are still developing in adolescence (Crone & Dahl, 2012; Dumontheil, 2015; Immordino-Yang, 2016). These conclusions are based on findings from multiple studies showing consistency in brain maturation, in terms of brain morphology and brain activity of brain regions supporting these specific abilities in adolescence. More specifically, studies show that cognitive and emotional skills are supported by complex, interconnected brain networks and that these organise as the learner develops (Immordino-Yang, 2016). This implies that they are controlled in part by genetic factors, but are also affected by experience[33] prior to and during adolescence, which causes individual variations among adolescents of the same age.

The brain's so-called default mode network (DMN) is a set of brain regions that have high brain activity when we rest and when we allow our thoughts to wander. The DMN has been shown to be associated with the same brain networks as those associated with the social brain network, including areas associated with mentalizing (Lieberman, 2012; Immordino-Yang, 2016). According to Gottlieb et al., 2016, giftedness, creativity and empathy also seem to depend on the same brain regions as in DMN.

It may indicate that rest and breaks are important for the stimulation of DMN, and thereby also brain regions supporting the social brain network (Lieberman, 2012; Gottlieb et al., 2016).

Studies have found that higher activity in parts of the DMN at rest is linked to better social skills (see Spunt et al., 2015). These findings indicate that there are individual variations among adolescents of the same age and that instruction can have an impact on the development of skills that depend on the same brain regions as those involved in the DMN.

Moreover, the mentalizing brain network seems to compete with brain regions supporting analytical thought and memorisation (Lieberman, 2012; Gottlieb et al., 2016). Neuroscientific evidence seem to support that brain regions associated with social-emotional abilities are less active when brain regions associated with executive functions are active (Gotlieb et al., 2016). Furthermore, executive skills and skills supported by the DMN probably contribute meaningfully to the development of adolescents' giftedness (giftedness is explained in footnote 3). This indicates the importance of stimulating the DMN.

There are several empirical studies pointing to adolescents being very responsive to social rewards that have been given by peers, as compared to children and adults. Social rewards seem to activate the same brain regions as non-social rewards, as well as regions associated with socio-emotional reward. One such brain region is the insular cortex (Guyer et al., 2009; O'Brien & Steinberg, 2010; Jones et al., 2014).

Some studies point to adolescents being hyper-responsive to unexpected positive rewards. These findings support those studies that indicate that in general the reward system is hyper-responsive in adolescence.

The above is consistent with one of the main points in Crone and Dahls (2012), which is that the social-affective system is a pronounced driving force in this life period.

POSSIBLE IMPLICATIONS FOR CLASSROOM INSTRUCTION

The findings presented above have the potential to pose relevant questions about the choice of instructional strategy in a high school context. For instance, knowing how the brain evolves during adolescence may explain and extend our understanding of students' behaviour in terms of their biological prerequisites for social cognitive aspects related to motivation for learning. In short, the evidence indicates: (1) That there *are* differences in the neuronal underpinnings of social cognition and socio-emotional abilities in adolescence compared with childhood and adulthood. (2) That these neuronal underpinnings depend on the biological maturity, including brain maturational condition, of the individual, controlled partly by genes and hormonal status, and to a lesser extent, but still affected by, past experience, (3) the possibility that instruction does have an impact on neuronal mechanisms associated with learning prerequisites, as well as learning processes of the individual in and after high school years. Knowing what to expect of students according to their biological development would seem to be an advantage in the choice of instructional strategy. This is obviously the case when there is empirical evidence that points out similarities in brain development supporting social behaviour in high school years. In the opposite case, reflecting on differences in social behaviour among students in terms of knowledge about their biological development might extend teachers' understanding of the degree of effectiveness of their choice of instructional strategies. Thus, neuronal underpinnings of social behaviour related to motivation for learning could provide teachers with empirically-based suggestions for their planning of future instruction. What is still to be explored are the similarities and differences in development, specifically within the age group representing late adolescence, as these may imply whether or not to differentiate between different instructional approaches according to the age of the students.

Neuroscientific evidence supports that the type of reward given, in terms of feedback, plays a significant role for motivation for learning in adolescence. Unexpected positive rewards might have a positive effect on motivation for learning in the long run. Evidence implies that an increased focus on student-student interaction, such as peer feedback, is advisable, as adolescents seem to be more responsive to social rewards, which may improve their performance on academic tasks that require executive functions. This might also be relevant in learning-for-teaching, in cases where peers are instructed to teach each other.

Neuronal underpinnings of motivation in terms of reward indicate that the management of social environment in a high school context does have an impact on

motivation for learning and thus on the learning processes of high school students. This supports the notion that *class management* matters if we wish to create a stimulating learning environment. This is further supported by research indicating that the social-affective system is a significant driving force in adolescence, which seems to be linked to higher performance in tasks involving executive functions, such as more traditional academic tasks.

Research on the DMN and social-emotional abilities supports the idea that having *breaks* from more traditional academic tasks stimulate the DMN and thereby, potentially social behavioural outcomes related to motivation for learning. We should consider selecting instructional strategies that allow students to get in contact with social-emotional inputs/reflections, allowing them to think creatively without having to use traditional academic skills, as the underlying neural mechanisms seem to compete.

Based on these insights, it seems fair to conclude that knowledge about the neuronal underpinnings of social aspects related to motivation for learning in late adolescence is worth taking into consideration, if we wish to stimulate motivation for learning among high school students.

SOME RESERVATIONS/LIMITATIONS ABOUT INFERRING THAT FINDINGS FROM NEUROSCIENTIFIC AND COGNITIVE STUDIES APPLY TO A CLASSROOM CONTEXT

Research on connections between the DMN and behavioural skills does not take brain maturation into account. A number of these studies are based on the assumption that brain regions supporting social cognitive and social-emotional skills seem to develop throughout adolescence. Researchers refer to findings from other studies about the changes in brain morphology as the underlying reason for changes in brain function and behaviour. Inferring from a structural level to a behavioural level, however, is linked to a number of uncertainties, and integrative and longitudinal studies exploring all three levels simultaneously are to be preferred. This requires that the researchers involved are competent in using their interactional expertise. Thus, the number of studies that succeeds in doing so and at the same time fulfil standard scientific requirements is an indicator of the quality of findings about correlations between brain maturation and learning in terms of social aspects related to motivation for learning. Longitudinal study designs shed light on individual variations as already stated, but they pose challenges too, ranging from recruitment of participants to modelling of brain development (see for example Mills & Tamnes, 2014; Paus, 2010).

A highly debated issue is how reliable fMRI technology is in detecting actual brain activity. Criticism revolves around several issues, such as the statistical assumptions that study designs lean on, as well as 'noise' in fMRI measurements due to motion of the subject in the scanner. Moreover, the experimental conditions do not resemble a complex social learning situation, such as the ones taking place in a high school setting. Furthermore, several researchers have disputed the existence of the DMN.

Generalising brain maturational trajectories according to age has also been disputed, because there seem to be a great deal of individual variations within each age group. Some researchers have suggested that using pubertal maturational stages as a parameter might be more reliable, as research findings indicate that there are interactions between pubertal hormones and brain maturation (e.g. review by Mills & Tamnes, 2014), which may also account for sex differences in performance. This also means that possible instructional interventions, based on knowledge about brain maturation, might be aimed at students who are at a certain pubertal stage, and not at a certain age. In general, intervention studies are needed to examine the impact of certain classroom instructions on the brain's development.

Lastly, studies exploring the effect of alcohol and drugs, changes in circadian rhythm, the role of diet, and the use social media in adolescence are highly relevant to include if we wish to unravel some of the main variables that may affect motivation for learning in adolescence.[34]

CONCLUSION

This chapter has presented a theoretical framework, inspired by Luhmann's systems theory, that aims to enhance communication between high school instruction and the didactic knowledge domain concerning neuroscientific underpinnings of social aspects related to motivation for learning in adolescence. The scope of this chapter is motivated by the increasing awareness about motivational issues among high school students, as well as a need to strengthen the theoretical field shedding light on motivation for learning in a high school context. The framework emphasises the advantages of a dialogue between four different didactic knowledge domains that separately and collectively have the potential to influence high school teachers in their choice of instructional strategy in a high school context, with a view to improving the learning processes of high school students.

The theoretical approach requires a systematic mapping of scientific communications about the knowledge representing this proposed didactic knowledge domain, in order to visualise its distinctive features that may guide high school teachers in how to navigate in these scientific communications. Furthermore, a dialogue between the four didactic knowledge domains will pose disturbing questions between them, which may help them to evolve further in serving as guiding principles for teaching practice. Such a dialogue has already been demonstrated here, as it serves as a starting point for the selection of themes that shape the fourth didactic knowledge domain. Scientific knowledge from the two didactic knowledge domains of educational science and learning theories indicate that if we wish to improve students' motivation for learning in terms of their intrinsic motivation, we should focus on improving social relationships between the teacher and the students, and between the students, promoting socio-emotional imagination as well as including social inputs in the curriculum. As pointed out, these aspects are relevant for a number of teaching activities that ultimately have an impact on the

learning outcome. In psychological terms, social behaviour involves social cognitive and social-emotional skills, and neuroscientific studies have in recent time shed light on correlations between neural processes and social behaviour, and this expands previous scientific understanding of this relationship.

The research findings representing the fourth knowledge domain reveal that understanding the fundamental principles behind brain development in adolescence has the potential to improve the understanding of students' prerequisites for learning, as well as the impact of classroom instruction on the brain's development, and thus on the students' prerequisites for learning after high school. More specifically, findings support psychological motivation theories and empirical educational studies that stress the importance of social cognitive as well as social-emotional skills in a learning context. Thus, these findings help to select existing learning theories that seem to be more effective than others. Furthermore, the findings have the potential to suggest new normative guidelines for teaching, as there is some evidence indicating that students might benefit from tasks that are not traditionally academic, but that allow students to think creatively and reflect on how learning activities are linked to personal future goals.

Another point that follows from the research presented here is that neuroscientific and cognitive findings do not necessarily reveal generalisations about correlations between neuroscientific underpinnings of social aspects of motivation for learning, but seem to shed light on differences/individual variability that might expand/nuance the understanding of social motivational aspects of learning processes. This potentially could lead to the conclusion that social cognitive aspects associated with learning processes are not as simple as some learning theories/cognitive models may indicate. This is an important point to take into account, because the instructional strategies being carried out in a learning context should ideally aim to motivate all high school students in a classroom.

We should bear in mind, however, that the fourth knowledge domain presented here is not well established, and that an understanding of the complexity of the methods and approaches involved seems to be necessary in order to be critical about the knowledge produced in different research studies. Furthermore, as most social neuroscientific and cognitive studies lean on assumptions about the fundamental principles of brain development, it is crucial to be aware of the consistency/reliability of these assumptions, in order to judge whether or not these grounds are scientifically valid. A mapping of the research field belonging to this didactic knowledge domain will constitute a solid starting point for the evaluation of relevant studies that lead to discovering the neuronal underpinnings of social aspects related to motivation for learning.

Finally, it can be concluded that the Luhmann-inspired theoretical framework put forward in this chapter *provides* a thorough systematic approach that *has* the potential to enhance communication fruitfully between the didactic knowledge domains that affect high school teachers' choice of instructional strategy in high school teaching, with a view to improving the learning process of high school students. From a broader perspective, the theoretical framework presented here has

the potential to enhance communication between neuroscience, educational science and educational practice in general.

NOTES

[1] Inner motivation is associated with spontanous inner joy and meaning, whereas outer motivation is associated with external consideration, often linked to the norms of society (Krogh & Anderson, 2013).

[2] Social-emotional imagination covers capacities to consider multiple cognitive and affective perspectives, courses of actions and outcomes for themselves and others (Gotlieb et al., 2016).

[3] The scientific paper revolves around giftedness, and how to stimulate giftedness in a school context. In scholastical contexts, giftedness is very often linked to academic talents. The authors emphasise the importance of social-emotional imagination, which involves a vision for a brighter future, confidence that the student can contribute to building this future, and lastly, creativity to try new things in the service of achieving the student's goals (Gotlieb et al., 2016).

[4] Mentalizing is defined as the ability to make inferences about mental states, such as intentions, beliefs and needs in oneself and in others (Burnett et al., 2010).

[5] The presented approach is being further developed in a current PhD project by Nadja Marie Mariager. This PhD aims to strengthen communication between neuroscience, educational science and high school instruction.

[6] Autopoiesis refers to a system capable of reproducing and maintaining itself (Luhmann, 2000).

[7] Every social action/interaction constitutes a situation with double contigency, which is recognised as such by both sides: both know that one could also act differently (Vanderstraeten, 2002).

[8] This research field constitutes its own system in the scientific system according to the theoretical approach put forward in this chapter.

[9] Such as epistemology, ontology, traditions and language.

[10] Typically explored trough intervention studies.

[11] Neuronal processes that are involved in brain maturation.

[12] Also termed cognitive control functions. Executive functioning skills are the processes and abilities that allow us to act in thoughtful, planned ways to achieve our goals. They include the ability to develop goals, plan the steps necessary to achieve those goals and inhibit urges to do things that do not align with what we are aiming to do (Benson & Sabbagh, 2013).

[13] Plasticity here refers to the influence of environment versus genetic factors on brain maturation.

[14] Structural.

[15] Here: brain activity.

[16] Grey and white matter volume (whole brain volume, volume of different cortical areas), cortical thickness, gyrification, white matter microstructure, subcortical volumes, structural connectivity (white matter fibre tracts), functional connectivity.

[17] According to the review of a number of scientific articles in the PhD project that this chapter leans on.

[18] For instance: Immordino-Yang, 2013.

[19] Regions of interest.

[20] http://www.abcdstudy.org/

[21] http://oxfordmindfulness.org/project/myriad/

[22] Here quality refers ro the validity of scientific findings.

[23] University of California, San Diego. Several of these research projects are being coordinated and analysed by the Center for Human Development, CHD, and the Center for Translational Imaging. Communications concerning the PLING study were being followed in the PhD Project, which is currently developing the theoretical framework presented here. The communications were being followed by means of observations and interviews with researchers involved in the study.

[24] www.chd.ucsd.edu/research/pling-study.html

[25] Applying the concept of 'Interactional Expertise' as a quality marker in the intersection of educational neuroscience was developed in Mariager, 2008.

[26] Cortical refers to regions in the neocortex, the upper layer of the brain that seems to be supporting higher cognitive functions.

[27] Grey matter: refers to tissue that is rich on cell bodies, dendrites and synapses.

[28] White matter: refers to tissue that is rich on myelinated axons. Myelin increases the velocity of neural signals throughout the neurons, strengthening communication in the brain. White matter is found in the deeper tissues of the brain (subcortical).

[29] According to a review of a number of scientific articles in the PhD project that this chapter is based on.

[30] Neurotransmission is the chemical transfer of signals between neurons. Necessary for communication between neurons.

[31] Incentive behaviour: a desired behaviour motivated by stimuli such as reward.

[32] Brain structures involved in the reward system that is dopamine-rich and sensitive to reward (Silverman et al., 2015).

[33] Experience in this context can be understood as upbringing, culture, social networks and learning environments.

[34] According to a review of a number of scientific articles in the PhD project that this chapter leans on.

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10. PATTERNS OF PARTICIPATION

A Participatory Account of Learning to Teach

> The word 'learning' undoubtedly denotes *change* of some kind. To say what *kind of* change is a delicate matter.
>
> (Bateson, 1972, p. 283, emphasis in original)

INTRODUCTION

Approaches to learning in educational scholarship may be characterised in terms of their affinity with two broad metaphors, those of learning as acquisition and learning as participation (Lave, 1997; Sfard, 2003, 2008). The relationships between and among frameworks in line with one or the other of these metaphors have been widely discussed in the literature, but less so in relation to teachers than to students. In what follows I introduce a participatory framework called Patterns of Participation (PoP). One intention in PoP is to phrase learning in terms that encompass what may in other frameworks referred to as knowledge growth, belief change, and identity development. The question I ask is how the kind of change called learning may be conceptualised (cf. the quotation from Bateson), if one adopts such an encompassing, participatory approach?

To address the question I initially discuss the metaphors of acquisition and participation as they relate to teachers and teaching. The intention is to outline dominant trends in how other lines of research on teacher learning relate to these metaphors. This section situates and serves as a backdrop for a presentation of the PoP framework. PoP draws primarily on social practice theory and symbolic interactionism and is situated in what Russ, Sherin, and Sherin (2016) refer to as the situative and socio-cultural perspective on learning to teach. It aims to understand (1) teachers' contributions to the interactions that emerge at their schools and in their classrooms (Skott, 2013); and (2) their experiences of being, becoming, and belonging as they relate to such interactions (Skott, in press). From a PoP-perspective, teachers' professional learning may be viewed as changes over time in these contributions and experiences.

I should point out that the present chapter is not an empirical piece in the sense that it presents the design, methods, and results of a particular study in any detail. I do refer to the use of PoP in empirical research, but the chapter should be read as an empirically informed theoretical essay. Also, and in contrast to many other publications

on teacher learning (cf. Fishman, Davis, & Chan, 2014), I do not at present focus on the processes and outcomes of comprehensive programmes for teacher education or development. Much writing in the field is on if and how particular programmes or other forms of support enable teachers to develop their teaching proficiency so as to align with current recommendations for educational reform. Notwithstanding the obvious potentials of such studies, the intention of PoP is currently less normative and the emphasis is at present on analyses of what it means for a teacher at the beginning of her career to learn to participate in school life in ways that allow her to be recognised as an accomplished colleague by herself and by others in the particular setting.

ACQUISITIONISM AND PARTICIPATIONISM IN RESEARCH ON TEACHER LEARNING

Each of the metaphors of acquisition and participation has been used about a variety of different approaches to learning, which are somewhat at odds with one another, but that nonetheless share one or a few key characteristics. When used about school based learning, acquisition generally refers to frameworks that carry connotations of learning as gaining individual ownership to objectified, mental entities, irrespective of the view of the learning process, that is, of how such ownership is achieved. Sfard (2008) suggests that an acquisitionist discourse on learning and thinking has metaphorical connotations that "make us think of knowledge as a kind of material, of human mind as a container, and of the learner as becoming an owner of the material stored in the container" (p. 49). Radical constructivism, with its assumption that "knowledge, no matter how it be defined, is in the heads of persons" (von Glasersfeld, 1995, p. 1), may be regarded as a paradigmatic example of a framework that conceives of learning as coming to own or possess particular contents. However, acquisition has also been used about frameworks that view the teaching-learning process as one of transmission (Lave, 1997).

In contrast, participatory frameworks consider human learning a matter of shifting modes of mediated participation in socially and culturally developed practices. Often drawing on Vygotsky (1978, 1986), such frameworks consider learning a process of moving from the periphery of the practice in question to participating more fully within the dynamic contexts in which the practice unfolds. This makes learning ubiquitous and in Lave's terms synonymous with "changing participation in the culturally designed settings of everyday life" (Lave, 1996, p. 6).

Approaches to Research on Teachers' Knowledge, Beliefs, and Identity

I have suggested elsewhere that different subfields of research on and with teachers tend to adopt different conceptual or theoretical frameworks and that the tendency to adopt acquisitionist approaches dominate studies of teachers' knowledge and beliefs (Skott, 2013). The development of both these fields is closely related to the constructivist revolution of the 1980s, and the constructivist orientation is often

still apparent. This is so in spite of a growing tendency to link teachers' knowledge and beliefs to practices in the classrooms in which these mental constructs are expected to be enacted. Drawing on Shulman (Grossman, Wilson, & Shulman, 1989; Shulman, 1986, 1987), studies of teacher knowledge suggest that there are types of knowledge and ways of knowing that are specific to the profession and that are linked closely to classroom interaction (e.g. Ball, Thames, & Phelps, 2008). This indicates that a standard university course on the subject matter taught does not suffice as a background for quality teaching, and that teachers need to acquire other knowledge more closely connected to instruction.

Somewhat similarly studies of teachers' beliefs draw for instance on Abelson (1979, 1986), Nespor (1987), Pajares (1992, 1993), and Rokeach (1969) and traditionally view teachers' beliefs as located in the mind of the individual and as an explanatory principle for practice (cf. Skott, 2009, 2015a). More recently the field has increasingly taken contextual factors into consideration and adopted less causal and more dynamic perspectives on belief-practice relationships (cf. Schoenfeld, 2011; Skott, 2015b). Generally, however, this does not question the understanding of beliefs as reified mental entities.

Between them these developments indicate that there is a growing concern that for teachers to 'enact' their knowledge and beliefs, their learning needs to be situated in close proximity to the practices that unfold in their current or future classrooms. However, the very notion of knowledge and belief 'enactment' carries the connotation that knowledge and beliefs reside within the individual. In this sense, these developments are still compatible with acquisitionism, and the main challenge that they pose to the traditions of their respective fields is that teachers need to hold other knowledge than traditionally taught and that the impact of their beliefs on practice may be modified by contextual constraints. However, it is not implied that a different conceptualisation is needed of what it means to know and believe (Skott, 2013).

In spite of that, a claim that research on and with teachers is based on acquisitionism needs to be modified. In particular the relatively recent research interest in teachers' professional identities is to a greater extent inspired by participatory accounts of human functioning (Beauchamp & Thomas, 2009; Brown & McNamara, 2011; Gresalfi & Cobb, 2011; Hodgen & Askew, 2007; Kazemi & Franke, 2004; Olsen, 2008; Van Zoest & Bohl, 2005). These studies draw for instance on discourse analysis (Gee, 2000–2001), complexity theory (Opfer & Pedder, 2011), and social practice theory (Holland, Skinner, Lachicotte Jr, & Cain, 1998; Wenger, 1998) to relate teacher learning to contextual issues, in a variety of different understandings of *context*, and view such learning as inherently linked to teachers' emerging and shifting professional identities. To the extent that the contents of instruction is considered in these studies, the question is often how teachers position themselves in relation to multiple and possibly conflicting discourses on the subject matter taught, for instance as framed within a dominant school culture and a specific teacher development initiative (Skott, in press).

Addressing the Split between Acquisitionist and Participatory Approaches

Clearly, the above picture of research on and with teachers is a simplification. However, there does seem to be a tendency for studies of teachers' knowledge and beliefs to draw primarily on acquisitionist (constructivist) frameworks, while studies of their professional identities generally adopt a more participatory stance. These differences in the theoretical and methodological underpinnings of the different research traditions and the inherent differences in the view of learning lead to a certain disconnect between them. They use qualitatively different units of analysis, research on knowledge and beliefs emphasising reified mental constructs located in the mind of the individual, identity studies focusing on some understanding of person-in-practice (Skott, Van Zoest, & Gellert, 2013). From this perspective the different subfields do not speak the same language, which results in some incoherence in the general field of research on teacher learning. This suggests that the field may benefit from addressing more carefully either (1) how to coordinate the contributions of the different frameworks across the acquisition-participation divide; (2) how acquisitionist approaches may address issues pertaining to teachers' identities; or (3) how participatory approaches may deal with what is traditionally phrased in terms of knowledge and beliefs.

My argument is, then, that the split in the general field of research on and with teachers into distinct subfields on their knowledge, beliefs, and identity is due not only to the different substantial foci, but at least in part to the use of different theoretical frameworks, the two first fields being primarily acquisitionist, while the last is generally more participatory. In turn this leads to an incoherence that may be counterproductive to the purpose of understanding the role of the teacher in and for classroom practice, as the subfields do not significantly inform one another.

To address this problem I opt for the third of the three possibilities mentioned above, and suggest that it may be helpful to develop a conceptual framework that interprets learning to teach in participatory terms. The PoP framework presented below views teaching, and human action and meaning-making more generally, as shifting modes of participation in a range of different present and prior practices in view of the ones that unfold at the instant. This means that the focus is no longer on enactments of teacher's knowledge and beliefs, again understood as relatively stable mental constructs. The dynamic and processual perspective, however, does not disregard a teacher's involvement with the content. It interprets her content-related contributions to classroom interaction as a response to the meanings (s)he makes of the situation at hand. As far as the contents is concerned the focus is on if and how the teacher in the particular situation engages in a content-related discourse (e.g. how to prove a particular conjecture in mathematics) and in value-laden meta-discursive practices on this content (e.g. considerations on why reasoning and proving is important in school mathematics). However, PoP-studies are also interested in if and how the teacher is simultaneously involved in other practices (e.g. an internalised

discussion with herself or others on how best to support students' self-confidence) that may significantly transform her engagement with the contents

POP: TOWARDS A PARTICIPATORY ACCOUNT
OF TEACHER LEARNING

Background to PoP

The lack of coherence in the general field of research on teacher learning is itself an impetus to search for frameworks that may overcome the split between the different subfields. As I have outlined elsewhere (Skott, 2013), however, there are also two other aspects to the background of PoP. First, it is based on dissatisfaction with the ways in which the problems and results of mainstream research on teachers' beliefs are generally dealt with in that field. The key concept of beliefs is ill-defined if defined at all, and partly as a consequence it is impossible to operationalise it in ways that shed sufficient light on these elusive constructs. Further, belief research is based on the assumption that teachers' beliefs significantly impact practice, and although this premise is rejected as much as confirmed in empirical studies (Fives & Buehl, 2012), it still orients the field. In spite of the more dynamic and less causal interpretations of the role of teachers' beliefs that have been developed recently (e.g. Schoenfeld, 2011), these problems still appear unresolved (Skott, 2015a).

While this provides a somewhat negative reason to look for alternatives to beliefs, a second and more positive argument was developed from a number of empirical studies that initially focused on beliefs, but gradually came to challenge the core concepts and assumptions of belief research (Skott, 2001, 2004, 2009a; Wedege & Skott, 2006). Building methodologically on developments of grounded theory (Charmaz, 2000, 2006), these studies resulted in more processual understandings of the role of the teacher in and for classroom practice. Increasingly, they became inspired by social practice theory and symbolic interactionism as fruitful approaches to understanding the functioning of teachers in mathematics classrooms.

Inspiration: Social Practice Theory and Symbolic Interactionism

In social practice theory *practice* is not conceived as 'somebody's practice', that is, in an individual possessive sense as when reference is made to 'a teacher's practice' (Holland et al., 1998; Lave & Wenger, 1991; Rogoff, 1995; Wenger, 1998). Rather, it is regarded as a communal, ever-evolving, and dynamic, though somewhat resilient, process and outcome of people interacting in particular contexts, which are recreated and further developed in the process. To participate in a practice is to engage in the negotiation of its meaning, and learning is synonymous with shifts and changes in such engagement and with the concomitant changes in the relation between the individual and the practice in question. Individual learning is closely related to identity and recast as becoming a certain kind of person in a particular setting.

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The main focus in studies of communities of practice is generally on how communal practices evolve and are regenerated, sometimes including how they relate to neighbouring practices and broader social structures. This means that a community-of-practice perspective may shed light on how an individual moves from peripheral to more comprehensive modes of participation in the practice in question. However, the perspective may underspecify experiences from other practices and consequently lose sight of the role they play for the individual as she moves into a new community. In other terms, the significance of participation in other past and present practices for the individual's contributions to the one that unfolds at the instant may be lost in empirical studies that focus exclusively on the current one. This suggests that there is a need to re-centre the individual in participatory accounts of learning, and focus not on any specific practice per se or on any combination of practices (e.g. that of a mathematics classroom or among the teachers in a department at a school), but on how individuals' participation in the practice in question (e.g. one that develops in a classroom) relates to their re-engagement in a multitude of other ones and how this relationship changes over time. My colleagues and I have found Chicago school symbolic interactionism helpful for this purpose (Blumer, 1969; Mead, 1934).

One of the apparently simple premises of symbolic interactionism is that people act in and towards objects in their world according to the meaning the objects have for them (Blumer, 1969). However, objects, that is, whatever people refer to in a particular situation, are social constructs and their meanings are neither located in the particular object itself nor a result of a purely psychological construction in the mind of the acting individual. Meaning is emerging in and from interaction, as "the meaning of a thing for a person grows out of the ways in which other persons act toward the person with regard to the thing" (Blumer, 1969, p. 4). In any interaction, then, people are constantly interpreting each other's verbal and physical gestures, including others' possible reactions to their own behaviour, and in the process they adjust their actions accordingly. This view of interaction is related to the I-me dynamic in Mead's conceptualisation of 'self' (Mead, 1934). As the I acts, the individual takes the attitude of individual and generalised others to herself and instantly becomes a me. In turn, this leads to adjustments or transformations of the initial act.

PoP Interpretations of Teachers' Actions

As an example of a PoP interpretation of teachers' actions, consider a mathematics teacher who seeks to support a group of students in developing an argument for their observation that the difference between two consecutive perfect squares seems to be the sum of the bases (e.g. that $6^2 - 5^2 = 6 + 5$). The teacher may have comprehensive experiences with mathematical reasoning and proving and may be able to prove the result for instance in an interview setting. (S)he may also in interviews emphasise that developing such arguments should be a core activity in school mathematics. However, as classroom processes unfold, she anticipates and interprets the words,

the tone of voice, the raised eyebrows, etc. of the students in question as well as of other students in the class. Also, her contributions to the interaction may change if she, while engaged in a mathematical discourse in order to assist the students, also orients herself towards a proposal for educational reform promoted by her teacher education programme; positions herself within a team of collaborating teachers whose cooperation focuses on the well-being of individual students rather than on their subject-matter learning; and attempts to document her own mathematical expertise, as her subject matter competence was recently questioned at a PTA meeting. In symbolic interactionist terms, the teacher takes the attitude of different individual and generalised others (the students, the teacher education programme, her team, the parents) and draws upon and renegotiates the meaning of the related social practices and discourses. These discourses and practices may function as what Holland and her colleagues call "figured worlds", that is, collective as-if worlds in which "particular characters and actors are recognised, significance is assigned to certain acts, and particular outcomes are valued over others" (Holland et al., 1998, p. 52). In this interpretation, the teacher relates at any point in time to multiple figured worlds that differ between them with regard to what it takes to be recognised as a legitimate or competent actor; what acts are considered significant; and what outcomes are valued. Yet, these figured worlds may all play a part for the teacher as the interaction unfolds.

PoP Interpretations of Teacher Learning

From a PoP perspective on novice teachers' professional learning, a key question becomes what changes occur in the significance, character, and mutual relationships among other practices and figured worlds that the teacher draws on in classroom interaction over the first few years of their career. As an example, consider the case of Anna (cf. Skott, 2013). Anna was in her mid-20s when she graduated as a lower-secondary teacher of mathematics from a college in Denmark. She was followed in a longitudinal case study for periods of time over the first three years of her teaching career. At the time of her graduation she was highly committed to her new profession, enthusiastic about current recommendations for reform in mathematics education (*the reform*), and also keen to develop close relationships with the students. She prioritised mathematics and was explicit that she was a *mathematics* teacher, rather than a teacher who happens to teach the subject.

As Anna begins to teach at Northgate Primary and Lower Secondary School, a municipal school in a well-to-do area of a large city, she establishes close collaboration with three experienced colleagues in a team that teaches all subjects to the three classes in a year-group. Anna is explicit that she is happy to be in charge of all mathematics teaching in the year-group, as she considers her own priorities as they relate to the teaching and learning of mathematics somewhat at odds with those of her colleagues in the mathematics department. Analyses of observations from Anna's classroom suggest that Anna draws on *the reform* and on mathematics as

figured worlds and on *relationing* and *teaming* as important practices that inform her contributions to her interactions with the students (cf. Figure 1). Also, these practices and figured worlds modulate one another and Anna's engagement with mathematics, for instance, is often significantly transformed by her concern not to jeopardize her relationship with the students and by the emphasis on investigative activities and student communication in the reform.

Throughout the study Anna is very committed to the tasks of teaching, but the significance of and relationships among the four previously dominant practices and figured worlds change. In particular, Anna increasingly acknowledges the professionalism of her colleagues in the mathematics department and she moves towards a more central position within the department herself. Also, she develops a positive working relation with the leadership, and she is asked for help and advice on administrative and educational issues by the headmaster and the deputy. In turn, these developments support a shift in her approach to instruction. Gradually she becomes less concerned with *the reform* and *relationing* and her engagement with mathematics in the classroom changes towards a somewhat stronger emphasis standard procedures. Learning to teach, then, has meant that the significance of some of the practices and figured worlds depicted in figure 1 has faded, while others related to Anna's position at Northgate have become more prominent and contribute to transforming her approach to the teaching of mathematics at the school. In the particular case, Anna develops from being 'a *mathematics* teacher at Northgate' and to a greater extent becomes 'a mathematics teacher at *Northgate*'. In the last interview Anna is explicit that she thinks she is a better teacher of mathematics now than when she first arrived at Northgate.
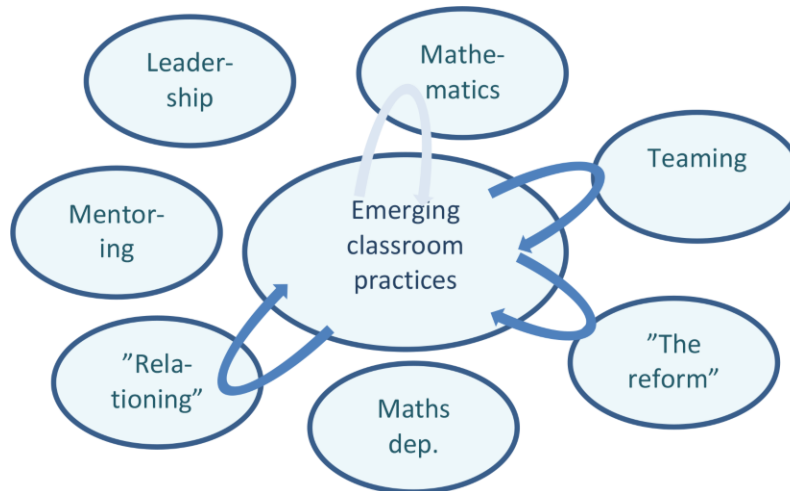

Figure 1. Dominant practices and figured at the beginning of Anna's career

As I have pointed out repeatedly, PoP-studies have primarily been used for analytical purposes. It has not been part of the endeavour to set up a list of criteria for what quality instruction is, let alone using such criteria for an assessment of the instructional approaches of teachers like Anna. Anna's comment in the last interview that she is now a better teacher is her own assessment. One interesting aspect of this, as seen from a PoP perspective, is if and how changes in her criteria for that assessment influence how she interacts with the students and in other ways contributes to school life.

CONCLUSIONS

Increasingly teacher education and development programmes have submitted the notion of communities of practice to the non-trivial transformation from being a primarily analytical construct to becoming a tool for educational design (e.g. Fishman, Davis, & Chan, 2014). This means that attempts are made to promote teachers' learning and professional competence through their participation in professional learning communities that are created as part of comprehensive development programmes. Such programmes generally emphasise particular aspects of current reform initiatives.

Notwithstanding the potentials of such initiatives, PoP is presently used for less normative purposes. My colleagues and I use it to theorise teacher learning in the majority of cases in which teachers are not enrolled in long-term programmes for professional development. Acknowledging that learning is ubiquitous (Lave, 1996), PoP investigates the reflexive relationships between novice teachers' shifting professional identities, their changing positions among their colleagues and at the school in general, and their contributions to emerging classroom practices. Analysing classroom interaction, we interpret teaching as an outcome of the teacher taking the attitude to herself of individual and generalised others, including different practices and figured worlds. The acts of teaching, then, are viewed as informed and pieced together by the teacher's re-engagement in significant practices and figured worlds beyond the classroom, the decision on which to draw on the particular situation based on the meaning she makes of the interaction itself. To stay with this metaphor, the size, shape, and colour of these other 'pieces', e.g. the character and influence of the reform or of the teacher's team, emerge in the process (Skott, 2013). Using PoP for analytical purposes we at one level of analysis seek to put together the jigsaw puzzle consisting of these pieces for different, individual classroom episodes that appear to be significant for the teacher in question. More to the point of professional learning, we build on longitudinal studies to point to trends and developments in the recurrent and possibly routinized ways in which the teacher engages with other practices and figured worlds as she interacts with the students and the contents. From a PoP perspective, teachers' professional learning may be conceptualised exactly as such trends and developments in the patterns of their contributions to classroom interaction.

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