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Teachers' professional development in terms of identity development – A shift in perspective on mathematics teachers' learning

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The theory of Communities of Practice (Wenger, 1998) provides a model of social learning whose assumptions differ from those made in the common theoretical frameworks of teachers' professional competencies. This shift in perspective on learning takes into account the concept of identity and connects it to the concept of practice. In this theoretical paper, we will clarify how teachers' learning works in terms of selected elements of Wenger's theory. Simultaneously, we will refer to empirical research findings on teachers' professional development and check whether they are in line with the theoretical considerations derived from the social perspective on learning.

Keywords: Teacher identity, teacher learning, professional development, identity development, communities of practice.

INTRODUCTION AND MOTIVATION

Facilitators of mathematics teachers' professional development are looking for effective ways of promoting teachers' learning. The term *learning* normally refers to a psychological-individual process of gaining professional competence, i.e., the capacity, skills or abilities to be more effective when teaching. A targeted aim of professional development programs is therefore not only to improve teachers' knowledge but also to change teaching practice on this basis and thereby to improve students' competencies (Lipowsky & Rzejak, 2012).

Schoenfeld (2011) considers that teachers' implementations of goal-oriented decisions – that make up an important part of teaching practice – do not only base on knowledge (and other resources) but also on context-dependent *orientations*. This summarizing term

comprises beliefs, attitudes, dispositions etc. and can be regarded as a notion that describes the affective-motivational characteristics of a teacher's professional competence. In this respect, Schoenfeld's term *orientation* frames, extends and in particular refines belief theory, since especially beliefs are very often discussed isolatedly from the complex surrounding framework.

Current research on teachers' professional competencies (Döhrmann, Kaiser, & Blömeke, 2012) as well as guidelines for professional development programs (Deutsches Zentrum für Lehrerbildung Mathematik, 2013) include both, cognitive competencies *and* motivational-affective characteristics of professional competence in the respective theoretical frameworks. This extension also marks a progress since the older postulate 'teaching should be cognitively enhancing' lacked the axiom that mathematics lessons should also be emotionally inspiring.

In accordance to Zehetmeier and Krainer (2011), teachers' learning can also be described in terms of knowledge, beliefs, and teaching practice. However, they conclude that further categories like "in-school levels" and "beyond-school levels" have to be considered when analyzing teachers' professional development: Which roles do colleagues and principles play for teachers' learning? Which impact is induced by students and the teachers' experiences in the classroom? And how does personal experience beyond professional practice in school constitute hindering or fostering factors for learning?

Particularly in our studies dealing with the professional development of so-called *out-of-field* teaching mathematics teachers, i.e. teachers without formal qualification for teaching mathematics, we real-

ized that considering cognitive competencies is not enough if we want to understand their actual professional practice (Bosse & Törner, 2014). In an ongoing analysis of interviews with this group of mathematics teachers, we can observe that identity-related aspects (e.g., experiences made with mathematics when the teachers were students themselves) influence their present teaching.

On this account, we want to change the perspective on teachers' *learning* from a psychological-individual transformation to a more holistic socio-cultural process in terms of *identity development*.

We will delineate teachers' learning as identity development as follows:

Firstly, we will give a short overview of the relevant literature locating teachers' learning as a social process in the field of theories of teachers' professional development.

Secondly, we will define the terms *identity*, *identity development* and *learning* by using the theory of *Communities of Practice (CoP)* (Wenger, 1998).

Thirdly, some important components of the CoP framework will be selected and discussed with the aim of explaining research findings and illuminating considerations of why mathematics teachers' professional development may be sustainable and effective or not.

Finally, we will critically reflect on our theoretical considerations and derive reasonable conclusions for designing effective professional development courses for mathematics teachers

TEACHERS' LEARNING IN COMMUNITIES OF PRACTICE

The socio-cognitive approach and identity in practice

Rösken (2011) comes to the conclusion that recognizing professional development as identity development means integrating "personality as a relevant variable in the classroom" (p. 25). In the same way, Alsup (2006) postulates that teachers should be seen as intellectuals in a lifelong process of learning but not as technicians whose possible shortcomings in

knowledge, beliefs, and practice have to be overcome via professional development programs.

This understanding of teachers' learning entails a *temporal-historic dimension*: Learning can be seen as the holistic process of turning an actual identity into a designated identity (Sfard & Prusak, 2005). Moreover, the notion of identity is directly connected to the role of *contexts* of teachers' learning. Beijaard, Meijer, and Verloop (2004) highlight that context is an important factor for analyzing and understanding identity development while Zehetmeier and Krainer (2011) even claim that communities and socio-cultural contexts have an impact on the sustainability of teachers' learning. Similarly, Beauchamp and Thomas (2009) come to the conclusion that information about contexts as well as communities and their influence on shaping teacher identities should be integrated into professional development courses.

Bohl and van Zoest (2002) have picked up the idea of using identity as an analytical and descriptive category of teacher development as well. In terms of our introduction, identity from their point of view is not exclusively located either "In-the-brain" or fully in the "Social". In fact, they assume identity being a "combination of aspects of self-in-mind and aspects of self-in-community" (p. 142).

Having this in mind, mathematics teachers' identities are therefore located within a socio-cognitive continuum: On the one hand, the aspects of self-in-mind relate to the areas of knowledge and beliefs, involving the domains of content, pedagogy and professional participation. This is in line with the perspective on teachers' professionalism and teachers' professional development in terms of competencies referring to individuals' psychological realms. On the other hand, Bohl and van Zoest (2002) consider identity as the "self-in-community", referring to processes of participation and perception within communities of practice.

In this paper, we want to focus on the social perspective of this mediating model. Of course, identity can be seen at various positions within the continuum, depending on the researchers' own identities (Grootenboer, Lowrie, & Smith, 2006). However, Grootenboer and colleagues (2006), reasonably sympathize with the idea that "identity is always connected to activity or practice" (p. 614), and *therefore*

a “useful construct for understanding the formation of mathematical teaching” (Grootenboer et al., 2006, p. 614). We want to follow this assumption when illustrating teachers' learning under the notion of identity development.

In the same respect, Skott, Moeskær Larsen, and Hellsten Østergaard (2011) argue in favor of shifting the research perspective on teachers' learning from the “underspecified” concept of beliefs (Skott, 2013, p. 548) to the patterns-of-participation framework. By doing so, it is possible to consider the relationships between teachers' identities and their participation in social practices (Skott, 2013, p. 511) which naturally comprise both, teaching in classrooms and teachers' learning in professional development courses.

Wenger's theory of Communities of Practice

In the theory of Communities of Practice (=CoP) (Wenger, 1998), identity development can be positioned at the very ‘social end’ of the above mentioned continuum. By doing so, Wenger describes learning from two points of view: The perspective of practice, in which learners are characterized as individuals taking part in socially-determined, community-based practices, and the perspective of identity, in which learners are considered as individuals, each being a member of different communities.

The crucial point of the CoP theory is a complex process called *Negotiation of Meaning* (=NoM), comprising the process of participation and the interconnected process of reification. It is a fundamental statement of the theory that NoM does not necessarily involve direct interaction with others but is a constant process in terms of experience in everyday life. Therefore, CoP theory can be applied to all mathematics teachers who are able to take part in a specific process of NoM, even though they are not able to interact directly because of geographical distance. Certainly, the theory can also be used naturally when referring to the learning of a group of mathematics teachers who attend a particular professional development course.

CoP-definition of identity: The assumption is that identity is the fully lived and negotiated *experience* of engagement in the practice of a community. In this sense, the definition of identity can be derived from the extent and quality of participated experiences and corresponding reifications through the process of NoM. Accordingly, identity exists as a constant work

of negotiating and therefore, identity is not a static entity but a constant “becoming”.

CoP-definition of identity-development: Because of the definition of identity alone, the historic-temporal dimension of a development process is already considered. Identity in the CoP theory is neither a core of personality that already exists at a particular beginning of a development nor a final state. Identity development occurs when so-called *trajectories* are formed due to the participation in communities of practice. These trajectories connect the past, the present and the future; however, they are not predefined paths but continuous motions occurring through the negotiated experiences which are made in the process of NoM.

CoP-definition of learning: In CoP theory, learning is characterized as “the engine” of practice and practice is described as “the history” of learning. This means that practice as an ongoing, social, and interactional process of NoM goes hand in hand with learning processes. As a consequence, educational processes based on actual participation in practice are effective in promoting learning since they are “epistemologically correct”. As a further consequence, Wenger (1998) underlines that there was a “match between knowing and learning, between the nature of competence and the process by which it is acquired, shared, and extended” (pp. 101–102). This assumption requires a competence term that basically differs from the individual-psychological one: Competence means knowing how to engage in practice, understanding the enterprise of a community of practice, and being able to use the shared repertoire of resources that is available to a community for using it in practice. In this sense, learning is becoming a member of a community by being familiar with its practices. However, since being a member of a community and being engaged in its practices is tantamount to the work of identity formation, learning and identity development are two interconnected, inseparable processes in the CoP theory.

MAPPING THE THEORY TO MATHEMATICS TEACHERS' PROFESSIONAL DEVELOPMENT

The coherence of a community and translations from community membership to identity

According to the theory, the practice of a community is based on three dimensions: *Mutual Engagement*,

a *Joint Enterprise* and a *Shared Repertoire*. As a community membership is defined by these dimensions, they are important when newcomers are supposed to become a new member of the community or peripheral members turn into core members. Applied to mathematics teachers' professional development, the extent of how these three dimensions are proportioned is an indicator of how likely the practice in a training course actually becomes a practice of teaching in a classroom – or in terms of identity – of how likely participating in a course transcribes identity as a form of competence into a teacher.

The mutuality of engagement in this manner is a crucial factor for teacher learning (Goos & Bennison, 2008). Are the teachers able to interact with each other and take part in the process of NoM? Is it possible that the teachers are actually in a position to be involved in the practices desired by the teacher educators? Or is the training course designed in a way that the teachers have no opportunities to engage at all? Research shows that participant-orientation is an important and effective element of teachers' professional development (Clarke, 1994).

In the CoP theory, a community additionally bases on a joint enterprise, i.e. the negotiated goals and the corresponding ways to achieve them. Here it is also a matter of how and how far the members of a community are actually accountable for the enterprise. According to the theory, teachers attending a professional development course will be more likely to develop their identities by gaining new perspectives on interpretations, choices and values if they are actually included in the process of negotiation. This issue is discussed in literature as the question of "ownership" of professional development (Zehetmeier & Krainer, 2011).

Becoming a member of a community in terms of the theory also means that newcomers have to learn how to use and interpret the repertoire of practice (styles, artefacts, actions, tools, concepts, discourses, stories, etc.). Therefore, effective professional development programs manage to translate the shared repertoire of the training course into a personal repertoire as a feature of a teachers' identity. Only by doing this, the teacher is able to apply the repertoire to new practices outside of or peripheral to the practices of the course. Hence, the question is if there should just be exposure to the repertoire and the related practices

or if the teacher should actually participate in the practice using the repertoire. Effective professional development is characterized by opportunities to try out practices in the classroom and by referring to the practices or cases of the teachers' actual teaching (Lipowsky & Rzejak, 2012; Timperley, Wilson, Barrar, & Fung, 2007). Therefore, one can further conclude that teachers need sufficient time during the professional development program in order to make use of the new repertoire of the course (Penuel, Fishman, Yamaguchi, & Gallagher, 2007) even if it is negotiated and not only presented.

In terms of the theory, mutual engagement, a joint enterprise and a shared repertoire are conditions for a coherent and robust community. Such communities or networks contribute to a sustainable and effective teacher learning. (Cochran-Smith & Lytle, 1999; Lipowsky & Rzejak, 2012; Zehetmeier & Krainer, 2011). If facilitators of mathematics teachers' professional development intend fostering collaboration in this sense, they should reflect on whether the three dimensions have actually been considered and how they can be integrated into the program.

Boundaries and multi-membership

Boundaries between different communities are defined by practice, not by institutional or organizational structures. All participants of professional development courses for mathematics teachers are teaching mathematics in school; however, they each have each experienced different practices of mathematics teaching in their individual professional life. It is therefore the usual case that a training course for teachers is an encounter between different communities whose respective members form a new community via practices negotiated within the frame of the course.

As a consequence, a professional development course implicates several boundaries between the practices of the respective teachers and a further significant boundary between the teachers and the teacher educators. The aim of a successful course in terms of the CoP theory is to allow crossing the boundaries by allowing the teachers to engage in the practice of other communities and especially in the teacher educators' practice. In this way, teachers should be able to use practices of other communities for the NoM at their own schools (Lipowsky & Rzejak, 2012). In other words, boundary crossing means the construction of an identity that includes different forms of practice.

On the one hand, this “multi-membership” requires the work of reconciliation: Teachers attending professional development programs must often cope with conflicting forms of practice, because they are supposed to develop identities and gain competences defined by teacher educators or even by outsiders. On the other hand, various forms of practice can offer new learning trajectories for the teachers and therefore constitute a basis for identity development.

The CoP theory considers two mechanisms of boundary crossing. Firstly, so-called *brokers* are able to transfer elements of one practice into another. In our case, the teacher educators themselves are brokers as they are able to translate, coordinate and align between different perspectives. Furthermore, teacher educators are capable of opening new possibilities for the process of NoM. The question is: Who is actually an effective broker, being able to allow boundary crossing and to promote identity development? In our opinion and with respect to the theory, successful brokers are teacher educators and mentor teachers who have strong experience in multi-membership themselves. This means that they have made experiences in teaching the content of the course in school as well as in educating teachers in the topic. This also means that these educators have experienced the content in a perspective of practice as well as in a perspective of theory. In conclusion, when it is not possible to find one single teacher educator who has experienced that multi-membership, the tandem approach could be helpful for initiating boundary crossing (Rösken, 2011, p. 81).

The second mechanism for initiating boundary crossing is the use of boundary objects like artefacts, documents, terms, concepts, styles and so forth. An object can become a boundary object if it allows different interpretations, each interpretation being based on the perspective of the respective community of practice. Such objects are particularly suitable for discussions: In which ways can a mathematical concept like derivations be taught? What kinds of activities are possible in order to teach the aspect of covariation between two variables? In which manner can the graphing calculator be a reasonable tool for teaching stochastic? Each answer and each corresponding perspective represents a specific practice and therefore individual experiences and identities teachers bring with them into professional development courses. We also know from literature that discussions and collab-

orative reflection are effective elements of teachers' professional development leading to processes of change (Zehetmeier & Krainer, 2011). Furthermore, students' documents, actually used textbooks, and videotaped lessons are suitable for being used as boundary objects in training courses since they connect the practice in school with the practice in the professional development program.

Modes of Belonging

As a part of his conclusion, Wenger (1998) introduces the three *Modes of Belonging* to a community and therefore having access to its practices: *Engagement*, *Imagination* and *Alignment*. Since engagement as an “active involvement in mutual processes of negotiation of meaning” (Wenger, 1998, p. 173) has already been discussed, we want to draw attention to the remaining two.

Imagination: This mode refers to the process of extrapolating from one's own experiences to future images of the world, future practices and future identities. Since imagination in terms of the CoP theory is not exclusively considered as an individual process but also as an integral feature of the collective process of NoM, imagination can be used as a source of identity development in a professional development program. In order to initiate processes of imagination, teacher educators should enable discussions and activities of self-reflection. By doing so, new learning trajectories are generated: How do teaching practices that are different from the experienced ones improve students' learning? What is it like to adopt teaching practices that vary from one's own teaching style? Lipowsky, Rzejak, and Dorst (2011) suggest that showing teachers videos of teaching practices that lead to an improved students' learning generate such trajectories. Teachers having observed these scenarios rather change their practices (Lipowsky & Rzejak, 2012) as they are able to see their own identities in the light of a different practice by means of imagination.

Alignment: Professional development programs usually intend aligning teachers to intended curricular requirements. Alignment in terms of the CoP theory comprises activities which lead to the adjustment of practices to broader structures and enterprises. In this context, Wenger (1998) emphasizes that the “challenge [...] is to connect local efforts to broader styles and discourses” (p. 186). In other words: Curricular requirements are commonly political or administra-

tional specifications which are not in line with the mathematics teachers' needs on a local level in the sense of a community of practice. Hence, the task for the facilitators of teachers' professional development is to negotiate the different perspectives by "convincing, inspiring and uniting" (Wenger, 1998, p. 186). A means for doing this might be coordinating boundary practices and reconciling diverging perspectives with the help of brokers and boundary objects.

CRITICAL REFLECTION AND CONCLUSIONS

With respect to educational designs, Wenger (1998) claims: "The primary focus must be on the negotiation of meaning rather than on the mechanics of information transmission and acquisition." (p. 265). This is in a particular way in line with the postulation of avoiding deficit-oriented approaches in teachers' professional development: Instead of analyzing deficits and filling the holes in teachers' professional competence profiles, philosophies of teachers' growth and empowerment are named (Rösken, 2011). We want to join the attitude of valuing the teachers' practice and the experiences they make in their classrooms every day. Therefore, we have the opinion that the CoP theory provides a framework of learning that respects the teachers' individual backgrounds they bring along into the professional development programs. In addition to that, we have shown that the shifts in perspective on teachers' learning are in line with the empirical findings concerning the effectiveness of professional development programs.

Nevertheless, we still have to think about how our considerations concerning teachers' learning in terms of identity development might be implemented in practice. A next step in this sense could be pondering appropriate teaching methods based on Wenger's ideas of learning and respecting the specific situation in mathematics teachers' training courses.

To be honest: Modeling professional development is a never completed, challenging task which involves many, partly cultural and administrative variables. We have learned that what is working in country x may be an unrealistic measure in country y. Last not least any theory has to handle these eventualities. It seems to us that Wenger's theory possesses this potential; however, this quality finally complicates its structure. To put it in another way: Wenger's contribution is not just a straight and lean theory.

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