

CONNECTING THEORIES IN A CASE STUDY OF PRIMARY SCHOOL MATHEMATICS TEACHERS' PROFESSIONAL IDENTITY DEVELOPMENT

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This paper focuses on a connection between two theories used in a case study of the professional identity development of primary school mathematics teachers. The two theories connected are communities of practice and patterns of participation. The reason for the connection was the need for a framework that would make it possible to analyse both the individual and the social parts of professional identity development. In this paper, the connection is presented, illustrated briefly using empirical examples and evaluated.

Keywords: Identity, identity development, framework, networking strategies

INTRODUCTION

The focus of this paper is a framework used in a case study of novice primary school mathematics teachers' professional identity development. The teaching profession, with or without focus on mathematics teaching, is often described in terms of a changed profession which lacks continuity between teacher education and schools (Cuddapah & Clayton, 2011; Frykholm, 1999; Goodman, 1998). Graduating from teacher education and starting work as a teacher is described as a transfer or shift in professional identity where the interplay between the individual and the context is highlighted as a central part about which understanding should be developed (Bjerneby Häll, 2006; Cuddapah & Clayton 2011; Persson, 2009). The reason for the connection between theories in the framework used in the present study was the need for a framework making it possible to analyse this interplay between the individual and the context.

Eistenhart (1991) distinguish between three types of research frameworks (theoretical, practical and conceptual) whereof the here presented framework is a conceptual framework. Such a framework is built from different sources, e.g. previous research and literature that the researchers argue as being relevant and important when addressing the research problem.

EPISTEMOLOGICAL STANCES

In the study of novice primary school mathematics teachers' professional identity development, two notions in particular are focused on: identity and professional competence. Both of these notions are objectifications which, according to Sfard (2008), imply that, instead of talking about them as processes expressed as verbs, we

talk about them as nouns as if they were physical objects. Objectification is not only a way of talking about the “same thing” it is also what creates the “things” we talk about and it is accomplished in two steps. The first step is reification which refers to how talk about processes and actions is converted into talk about objects. We observe actions but talk about them as objects (*he has got a lot of knowledge*). The second step in objectification is alienation where the objects are presented in an impersonal way as if they existed independently without the presence of specific people (*the level of knowledge in society is too low*). As objectified notions are originally based on actions they need to be de-objectified for it to be possible to study them. In the development of the framework in the present study, such a de-objectification of the objectified notions *identity* and *professional competence* needed to be done.

According to Lerman (2000), research into mathematics education has “been turn[ed] to social theories” (p.20). He bases this on mathematics education research since the late 20th century, sees meaning, thinking and reasoning as products of social activities where learning, thinking and reasoning are seen as situated in social situations. The term situated refers to a set of theoretical perspectives and lines of research which conceptualise learning as changes in participation in socially organised activities and individuals’ use of knowledge as an aspect of their participation in social practices (Borko, 2004). Whereas cognitive perspectives focus on knowledge that individuals acquire, situative perspectives focus on practices in which individuals have learned to participate (Peressini, Borko, Romagnano, Knuth and Willis, 2004). To participate means both to absorb and be absorbed in a community and Sfard (2006) describes this duality as “*individualization of the collective*” and “*collectivization of the individual*” (p.158, italicising the original).

From a situative perspective, teacher learning is a process of increasing participation in the practice of teaching and, through that participation, becoming knowledgeable in and about teaching. To understand teacher learning, it must be studied within the multiple contexts within which teachers do their jobs, taking into account both the individual teachers and the social systems in which they are participants (Borko, 2004).

THE DEVELOPMENT OF THE CONCEPTUAL FRAMEWORK

A connection between theories depends on the structure of the theories involved and the goal of the connection (Radford, 2008). The goal of the connection presented in this paper was to better understand an empirical phenomenon by including both the individual and the social parts of identity development. Also, based on the epistemological stances, the theories was to be within a situative perspective with identity and professional competence as processes and not objectified objects.

The starting point in the search for a theory suitable to describe and understand the professional identity development of novice primary school mathematics teachers became theories focusing on identity and identity development. After exploring several theories Wenger's (1998) was found to be suitable and in line with the epistemological stances. However, his theory doesn't focus on mathematics education and/or teaching. There is no one definition of what constitutes professional competence for mathematics teachers but in research beliefs and/or mathematical knowledge for teaching is often focused on. However, traditional definitions of beliefs and mathematical knowledge for teaching are objectifications and the situative participatory perspective to be used in the here presented study was not in line with the acquisitionist perspective often used in research of beliefs and mathematical knowledge for teaching.

According to Skott (2010), the social turn that has been developed in research regarding other areas within mathematics education also needs to be developed within beliefs research. If beliefs research is to become social, the pre-reified and the pre-alienated processes of teachers' participation need to be focused on. Skott suggests a shift from focusing on objectified beliefs to focusing on patterns-of-participation as searching for patterns in how teachers participate in immediate situations and prior social practises. Skott's theory is in line with the epistemological stances of the study and focusing on those parts that were missing (mathematics education and/or teaching) in Wenger's theory and became the second starting point of the conceptual framework. Below first Wenger's theory will be presented followed by Skott's theory and after that the connection will be focused on.

Identity and identity development

According to Wenger (1998), identity formation is a complementary dual process in which one half is identification in communities of practice and the other half is the negotiation of the meaning in those communities of practice. A community of practice is a set of relationships between people, activities and the world; it is a shared learning history. The system of activity in a community of practice involves mutual engagement, joint enterprise and a shared repertoire. Mutual engagement is the relationships between the members, about them doing things together as well as negotiating the meaning within the community of practice. Joint enterprise regards the mutual accountability the members feel in relation to the community of practice and it is built by the mutual engagement. The shared repertoire in a community of practice regards its collective stories, artefacts, notions and actions as reifications of the mutual engagement. The shared repertoire proceeds from, and is a resource in, the negotiation of meaning within the community of practice.

An individual can participate in a community of practice through engagement, imagination and/or alignment (modes of belonging). These three ways of identifying and negotiating involve different approaches and different conditions and they do not

require or exclude each other. Participation through engagement implies active involvement in a community of practice and requires the possibility to participate in its activities. Participation through imagination implies going beyond time and space in a physical sense and creating images of the world. Participation through alignment implies that the individual aligns in relation to the activity system the individual wants to, or is forced to, be a participant of. Imagination and alignment make it possible to feel connected to people we have never met but whom, in some way; match our own patterns of action.

According to Wenger (1998), identity is a never ending negotiation and identification in communities of practice and, as such, identity is not an object but an endless becoming. Identity is temporary and identity development is constantly ongoing as a learning trajectory through a cluster of communities of practice. Our identities are shaped in the tension between our different memberships in various communities of practice and the identification and negotiation within these.

Professional competence

Pattern-of-participation research has been developed as a de-objectified participatory alternative to traditional research of beliefs (Skott 2010; Skott, Moeskær Larsen & Hellsten Østergaard, 2011) and mathematical knowledge for teaching research (Skott, in press). According to patterns-of-participation research a teacher participates in multiple simultaneous practices in the classroom and there are patterns in the ways in which the teacher participates in these practices. Researching patterns-of-participation is searching for patterns in teachers' participation in immediate situations and prior social practises, whereof some are mathematical. The aim in patterns-of-participation research is to understand patterns in how a teacher's interpretation of and contribution to immediate social situations relate dynamically to her prior engagement in a range of other social practices, not to her beliefs or mathematical knowledge as objectified mental constructs.

As such, patterns-of-participation are valid as the pre-reified and pre-alienated statements and/or actions previously objectified as mathematical knowledge for teaching or beliefs. Which statements and/or actions that were previously objectified as beliefs or mathematical knowledge for teaching respectively is no longer of interest. If the aim is to understand mathematics teachers and their mathematics teaching, their patterns-of -participation, their pre-reified and pre-alienated processes of participation, are of interest.

Connecting patterns of participation and identity development

The shift from beliefs and mathematical knowledge for teaching to patterns-of-participation makes a connection to identity and identity development according to

Wenger (1998) possible. What Skott (2010) and Skott et al. (2011) call multiple simultaneous practices can be treated as communities of practice. A conceptual framework can be developed within a participatory perspective, making both the individual and the social possible as units of analysis where patterns-of-participation can be used to describe the-social-in-the-teacher-in-the-social (*individualization of the collective*) and communities of practices can be used to describe the-teacher-in-the-social-in-the-teacher (*collectivization of the individual*).

Wenger analyses identity development while Skott (2010) and Skott et al. (2011) analyse teaching situations. Both theories include the individual and the social but with different focus and different emphasis.

In all of this, patterns from the teacher's prior engagement in social practices are enacted and re-enacted, moulded, fused and sometimes changed beyond recognition as they confront, merge with, transform, substitute, subsume, are absorbed by, exist in parallel with and further develop those that are related to the more immediate situation (Skott, Moeskær Larsen & Østergaard, 2011, p.33).

[...] it [identity] is produced as a lived experience of participation in specific communities. What narratives, categories, roles, and positions come to mean as an experience of participation is something that must be worked out in practice. An identity, then, is a layering of events of participation and reification by which our experience and its social interpretation inform each other (Wenger, p.151).

In the citation of Skott et al. above, the focus is on the immediate situation with "prior engagement in social practices" in the background. In the citation of Wenger, the relationship between situations and social practices (that is, communities of practice) is the opposite, with communities of practice in the foreground and the imprints must be "worked out in practice". As such, patterns-of-participation offer a language with which to explain what is happening in situations while communities of practice offer a language with which to explain the emergence of the patterns-of-participation.

Horn, Nolen, Ward and Campbell (2008) distinguish between a situation as an arena or as a setting. Arena refers to the "physically, economically, politically and organized spaces-in-time" (p.63) whilst setting refers to "personally ordered and edited versions of the arena that arise as individuals interact in these contexts" (p.63). An individual's interpretation of an immediate situation (an arena) into a setting is based on his or hers nexus of memberships in communities of practices. The participation of the teacher is double. At the same time as an individual participates in an immediate situation (the focus of Skott), she participates in several communities of practice (the focus of Wenger).

Wenger's theory becomes useful when analysing an individual's different participation in different communities of practice. Skott's theory becomes useful when analysing how such different memberships in communities of practice

influences how the individual interprets and acts in immediate situations. Skott et al. (2011) write that it is the responsibility of the researcher to disentangle if and how a teacher's participation in past and present practices influences the classroom. Through combining patterns-of-participation and communities of practice such an analysis is possible. Based on analysis of the individual's participation in forms of engagement, imagination and/or alignment, interpretations can be made about communities of practice the individual seems to negotiate and/or identify with and how these memberships influence the merged patterns-of-participation.

According to Wenger (1998), identity development is an individual's learning trajectory through different communities of practice. That learning trajectory can be viewed through changes in the individual's patterns-of-participation in settings over time. To talk about professional [primary school teacher] identity based on participation in communities of practice means freezing the ongoing process. To talk about professional [primary school teacher] identity development based on learning trajectories in communities of practice means freezing the ongoing process several times over a prolonged time. By freezing and objectifying the ongoing process, one can talk about professional [primary school teacher] identity; however, it is important to remember that the identity is not an object within the individual but an objectification of an ongoing process.

USING THE CONCEPTUAL FRAMEWORK

In this section some short examples are given of how the conceptual framework may be used when analysing empirical material. The excerpts are from analysis made in the case study of novice primary school mathematics teachers' professional identity development. However, here the aim is not to analyse the identity development of these novice teachers but to show how the conceptual framework may be used when analysing empirical material.

The empirical material in the study was collected through self-recordings made by the respondents, observations and interviews. These varying empirical materials have different characteristics but are treated as, named by Aspers (2007), complete-empiricism, implying all the material constitutes a whole on which the analysis is based. Based on the conceptual framework research questions can be asked about the patterns-of-participation of one or several teachers, why these patterns-of-participation occurs, the modes of belonging in communities of practices of one or several individual and the influence of these belonging on patterns-of-participation.

The first example is an analysis of the mathematics teaching of Nina, one of the respondents, when she one day is teaching mathematics outdoors. In the example, the communities of practice are given names based on their shared repertoire so as to be distinguishable. As seen the analysis is not based solely on what is observed in the specific situation but on the complete-empiricism in the case of Nina.

Three communities of practice are visible in Nina's patterns-of-participation in this teaching situation, the community of reform mathematics teaching, the community of teachers working in grade two and the community of teachers at Aston School. Her actions seem to be a merger of the shared repertoires in these three communities. Working with mathematics outdoors is part of the shared repertoire in the community of reform mathematics as well as the focus on students' communication. The emphasis on working fast to finish as many questions as possible is part of the shared repertoire in the community of teachers working in grade two. Finally, Nina's worries regarding if the students really learn and how she is to prove to her colleagues that they do is her participating in the community of teachers at Aston School.

Further different communities of practices can be analysed based on their mutual engagement, joint enterprise and shared repertoire. Similarly, the respondent's modes of belonging (engagement, imagination and/or alignment) in them can be analysed. The imprints of these modes of belonging can be analysed both with focus on the teacher as the social-in-the-teacher-in-the-social or on the communities of practice as the-teacher-in-the-social-in-the-teacher. Such analyses shed light on how the individual's patterns-of-participation regarding teaching mathematics are influenced by and influence communities of practice. Below is first an example where the focus is on the teacher when analysing a pattern that occurs in several of the mathematics lessons taught by Barbro, another of the novice teachers in the study. In the next example the focus instead is on the community of practice.

Barbro's mathematics teaching is strongly influenced by the community of teachers working in preparatory class. Her mode of belonging in this community of practice is engagement and also imagination as becoming "totally qualified" by writing her essay. The mutual engagement in the community is students learning Swedish. Even when Barbro is teaching mathematics her main focus is on the students learning Swedish and she gets positive feedback regarding this from other members in the community of teachers working in preparatory class.

The mutual engagement in the community of teachers working in preparatory class is students learning Swedish. This joint enterprise is negotiated by the members in a harmonious way. Even so, there is a visible hierarchy between the members which seems to be based on their education. One part of the negotiated shared repertoire is not to speak English even when it could be a possible help for the children to understand the tasks in the mathematics text book.

Finally, analyses focusing on individuals, over a prolonged period of time makes professional identity development visible as learning trajectories in nexus of communities of practice and the conceptual framework helps to answer questions regarding how and why, for example as below when analysing one changed pattern in Nina's mathematics teaching.

The merger of the shared repertoire in the community of teachers working in grade two and the community of reform mathematics teaching has changed Nina's pattern

regarding mathematics teaching. Last semester, before she became a member of the community of teachers working in grade two, she expressed the repeated pattern of the text book as something less good but now she stresses it as something good since “it is easy for the children to understand”. The same expression is often heard by the other members of the community of teachers working in grade two. In the community of teachers working in grade two, Nina is a member by engagement and she is active in the negotiation of its shared repertoire. Regarding the community of reform mathematics teaching, her new employment this semester is preventing her membership by engagement. As such, her mode of belonging is now in the form of imagination and it doesn't seem to influence her pattern regarding talking about and using (or not using) the text book in the same way as it did last semester.

EVALUATING THE CONNECTION IN THE FRAMEWORK

The connection between Wenger's (1998) and Skott's (2010) and Skott et al's (2011) theories implies a conceptual framework enclosing the process of professional identity development. The goal of the connection is to better understand an empirical phenomenon (identity development as a primary school mathematics teacher). Connections between theories could, according to Radford (2008), be made at the level of principles, methodologies, or questions or as a combination of these. In this study, the question constituted the need of the connection. Regarding methodology, neither Wenger (1998) nor Skott (2010) or Skott et al (2011) mentions it in their theories. However, based on the conceptual framework, inferences can be drawn about what kind of data should be collected. To be able to discover patterns-of-participation and communities of practice, an attended approach, e.g. ethnography, is needed. Regarding the basic principles both theories are within a participatory perspective focusing on processes involving both the individual and the social.

Österholm (2011) compares patterns-of-participation research with traditional beliefs research and writes that when researching patterns-of-participation, all prior experiences are of interest and that there seems to be a need for some form of separation between the different practices and different kinds of memberships. This sought after separation is acquired by the connection between patterns-of-participation and communities of practice. Further, Österholm writes that within patterns-of-participation research, it seems to be difficult to talk about change since there is nothing to change. The connection between communities of practice and patterns-of-participation presented here makes visible the process of constant mutual change in patterns-of-participation and communities of practices.

The cores of Wenger's (1998) and Skott's theories may appear rather different at first sight. The two theories have different ranges. Skott's theory is new and under development, while Wenger's theory is better established. Wenger's starting point is learning and Skott's is beliefs. However, the two theories have a common starting point when looking at old phenomena (learning – beliefs) but from a (new) social perspective.

Wenger's (1998) starting point is to make a social theory of learning and Skott's (2010) is to turn beliefs research social. Social may, however, imply different things in various degrees. Wenger asks the question, "what if we [...] placed learning in the context of our lived experience of participation in the world?" (p.3). Similarly, Skott suggests, "that a more participatory stance is adopted in research on the role of teachers for classroom practice" (p.1). The basic claim behind the notion of participation is that "patterned collective forms of distinctly human forms of doing are developmentally prior to the activities of the individual" (Sfard, 2006, pp.157). Further comparison shows that there are some connections between notions in the two theories. Wenger (1998) writes that knowledge always undergoes construction and transformation in use, and that things assumed to be natural categories, such as "bodies of knowledge", "learners" and "cultural transmission", require reconceptualisation as cultural, social products. This can be compared with Skott's (2010), Skott et al's (2011) and Skott's (in press) re-reification goal. What Wenger calls "cultural transmission" and "bodies of knowledge" respectively can be seen as similar to traditional reified beliefs or mathematical knowledge for teaching. Both Skott and Wenger work with re-reification focusing on processes. Certainly, a community of practice is a reification, but Wenger's theory is about the process of identity and identity development in and of those communities of practices.

In summary, if, using the words of Prediger, Bikner and Arzarello (2008), the conceptual framework implies coordination as built by well-fitting elements from different theories, being useful when the empirical elements of the theories complement each other and, coordinated thus, support a more complete analysis.

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