Developing an identity as a secondary school mathematics teacher:
Identification and negotiability in communities of practice

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The paper reports from analyses of one Norwegian secondary school mathematics teacher (Isaac) in his transition from university teacher education to employment in secondary school. The process of becoming a mathematics teacher is studied in terms of identity, based on the teacher’s participation within and at the boundaries of communities of practice at university and school. Adopting a longitudinal case-study design and methods from narrative analysis, the case of Isaac displays tensions between desires for own mathematics teaching and experiences of possibilities in practice. The case illustrates how the concept of identity is helpful for gaining insight into mathematics teachers’ ability and legitimacy to contribute to, and take responsibility for, the meanings that matter regarding mathematics, its teaching and learning, in their professional debut.

Keywords: Identity, community of practice, secondary mathematics teaching, narrative analysis.

Introduction

Mathematics teacher identity has been explored from a range of theoretical perspectives, spanning from categorising aspects of teacher identity in order to describe it and better understand the possible influences on teachers’ practice, to viewing identity as a function of participation in different communities of practice (Beauchamp & Thomas, 2009; Darragh, 2016; Lutovac & Kaasila, 2017). In their overview, Beauchamp and Thomas (2009) find identity to be considered across the literature as dynamic and a constantly evolving phenomenon, being under the influence of a range of individual and external factors. They discuss a variety of issues that surface in the attempt of defining the concept of identity: the role of agency and emotion in shaping identity, the power of stories and discourse in understanding teachers’ identity, and the contextual factors that promote or hinder identity development. Similarly, Lutovac and Kaasila (2017) find studies on mathematics teacher identity to address multiple themes, for instance theoretical models for defining identity, affective relationships with mathematics and changes in teacher identity, and the link between identity and teaching practices. However, studies focusing on social practices and structures within which teacher identities develop seem to predominate in the research field. In this paper, I adopt identity as a theoretical concept for better understanding the participative experiences of one newly educated mathematics teacher, when entering a secondary mathematics classroom. The purpose of the study is to gain insight into the dynamics of one mathematics teacher’s learning, as he moves across different mathematics practices at the university and at school and unites his experience into a role as a secondary school mathematics teacher. According to Palmér (2013), studies on mathematics teachers often provide an external perspective, where the researcher observes and evaluates teaching in order to describe the teacher’s knowledge and/or beliefs across contexts. However, in order to understand better mathematics teachers’ challenges and opportunities when entering the profession, I instead search for in this paper the individual teacher’s own meaning-making of himself as an actor of mathematics teaching, and the development of this
meaning-making in the professional debut. Studying teacher learning within and across practices, the notion of identity becomes then a conceptual tool for investigating how a mathematics teacher negotiates meaning with others and how he regulates his participation according to reactions of others to him (Ponte & Chapman, 2008). The research reported is based on a larger study of three Norwegian secondary mathematics teachers’ entrance into the teaching profession (Rø, 2018), from which the overarching research question is: How do three prospective secondary school mathematics teachers identities develop in the transition from university teacher education to school? In the subsequent section, I present the theoretical basis for investigating mathematics teacher identity, in which it is considered as a dual process of identification and negotiability from participating in communities of practice (Wenger, 1998). Adopting a longitudinal case-study design and methods from narrative analysis, I further report on and discuss results from a series of interviews with one newly qualified mathematics teacher, Isaac, during his first year as an upper secondary school mathematics teacher. Thus, this paper seeks to answer the following sub-question: What are the participative experiences of one newly educated mathematics teacher, when entering a secondary mathematics classroom?

Mathematics teacher identity in communities of practice

Within the frames of Wenger’s (1998) social learning theory, a prospective mathematics teacher’s movement between university teacher education and employment in school implies various forms of participation in communities of practice, and the work of reconciling memberships across the community boundaries (Akkerman & Bakker, 2011). The concept of community of practice refers here to a set of relationships between people, who share some kind of competence through interaction, communication and negotiation of meaning (Wenger, 1998). When moving between practices, the prospective mathematics teacher is then negotiating ways of being a person in a community, e.g. being a student teacher in mathematics, being a schoolteacher, a teacher colleague, and an employee. Hence, the existence of a community of practice concerned with mathematics teaching and learning is a negotiation of related identities. On this basis, Wenger (1998) defines identity as negotiated experience of self when participating within and between communities of practice. Developing an identity as a mathematics teacher can thus be characterised as “increasing participation in the practice of teaching, and through this participation, (…) becoming knowledgeable in and about teaching” (Adler, 2000). A gradual change in participation, from the periphery towards the centre of a community of practice, is by Wenger (1998) described in terms of three modes of belonging: engagement, imagination and alignment. For instance, a prospective mathematics teacher might engage with ideas of inquiry based mathematics teaching through involvement in communicative practices with other community members (e.g. teacher educators, tutors, fellow student teachers, students in the classroom, teacher colleagues) during teacher education or in school. Consequently, he takes part in ideas of mathematics teaching through imagination, by envisioning himself as a teacher in a future classroom who is implementing the community’s practice. Doing what it takes to play part in the community, the prospective teacher also aligns with the conditions or characteristics of the community’s practice. This can take place through reading and sharing relevant literature with other actors, implementing inquiry based activities in own mathematics teaching and being involved in professional development projects on
inquiry based mathematics teaching. Further, each of the three presented modes of belonging can be a source of the dual process of identification and negotiability (Wenger, 1998). Identification concerns a person’s investment in various forms of belonging to community practices, being both participative (“identifying with”) and reificative (“identifying as”). In other words, identifying with a mathematics teaching practice or a group of actors of mathematics teaching is simultaneously a process of being identified as a special kind of mathematics teacher. Processes of identification with community practices thus define which meanings matter to the prospective teacher regarding mathematics teaching and learning. As an example, a mathematics teacher can identify himself with a community of inquiry based mathematics teaching by aligning with a joint learning objective of facilitating students’ mathematical confidence and social empowerment. These learning objectives are related to perspectives of the subject of mathematics as being a social construction: “tentative, growing by means of human creation and decision-making and connected with other realms of knowledge, culture and social life” (Ernest, 1991, p. 209). Through inbound participation in the community, the teacher’s identity will then develop in correlation with the negotiated perspectives on the nature of the discipline. However, processes of identification does not determine the teacher’s ability to negotiate these meanings. Negotiability, then, refers to the “ability, facility, and legitimacy to contribute to, take responsibility for and shape the meanings that matter within a social configuration” (Wenger, 1998, p. 197). As an example, the meanings that a mathematics classroom community (teacher and students) produce of mathematics, its teaching and learning, are not only local meanings. They are also part of a broader economy of meaning in which different meanings are produced in different locations and compete for the definition of what mathematics teaching and learning is or should be. Consequently, some meanings of mathematics teaching and learning achieve special status. Wenger’s (1998) notion of ownership of meaning refers here to the teacher’s or the students’ ability to take responsibility for negotiating the meanings of mathematics within the classroom community. The interplay between the mathematics teacher’s expressed identification and his voiced negotiability displays therefore possible tensions between how he desires his mathematics teaching to be and what he experiences as possible in practice. Thus, it gives insight into the characteristics of mathematics teacher identity development in the beginning of a mathematics teacher career.

A narrative approach to mathematics teacher identity

Taking an operational approach to the concept of identity, I follow Elliott (2005) and Sfard and Prusak (2005), who link identity to the activity of communication. According to them, narratives provide the practical means by which a person can understand himself as living through time, and thus, make identity accessible and investigable. Through a narrative lens, a prospective teacher can make sense of his process of becoming a mathematics teacher by selecting elements of experience regarding mathematics teaching and learning, and patterning the chosen elements in ways that reflect stories available to the audience. This temporal characteristic of narratives is in line with Wenger’s (1998) interpretation of identity as a learning trajectory, when incorporating “the past and the future in the very process of negotiating the present” (p. 155). Similarly, Carter and Doyle (1996) state that a narrative approach to identity emphasises the negotiated nature of becoming a mathematics teacher. Mathematics teacher identities are not simply formed by life experience prior
to, during or after teacher education programmes. Rather, the teachers are active participants in interpreting their experience, “searching for and constructing images that capture the essential features of their understanding of the tasks they encounter in [mathematics] teaching” (Carter & Doyle, 1996, p. 134). This paper presents identifying narratives of one newly educated mathematics teacher (Isaac), based on three consecutive semi-structured interviews distributed across his first year as a mathematics teacher in upper secondary school. Inspired by Elliott (2005), each interview was introduced by an invitation to talk freely about experiences from undergoing subject studies in mathematics, university teacher education, and/or experiences from being a newly qualified mathematics teacher. To cover important parts of Isaac’s life as a learner and teacher of mathematics, the storytelling was followed by questions outlined in an interview guide. The follow-up questions concerned Isaac’s first mathematics teaching experience, memories of good and less good mathematics lessons, peaks and disappointments regarding mathematics teaching and learning, and his expectations about the future. Adopting methods from narrative analysis (Polkinghorne, 1995), I sought to create coherence across themes and plots in what was told throughout the interviews. I divided the interview transcripts into segments where a certain topic was discussed. Based on comparison and contrast of the segments within and across interviews, I developed labels due to the segments’ thematic focus. Further, I sorted the labels into greater categories or emergent themes of Isaac’s accounts. The emergent themes developed from analysis of the first interview were brought into the analysis of the second interview, being confronted by labels given to segments in the transcripts. If necessary, the emergent themes were refined or new themes were developed. The narrative analysis led to three emergent themes in which Isaac’s building of a mathematics teacher identity is expressed: confidence in mathematics and mathematics teaching, perspectives on mathematics and its role in mathematics teaching and feedback available within the school environment. For each emergent theme, I interpreted the associated accounts by means of the theoretical framework. Hence, I searched for evidence of Isaac’s participation in communities of practice, based on Wenger’s (1998) two components of identity: identification and negotiability. Making a longitudinal approach to the accounts, I further looked for changes in Isaac’s expressed identification and negotiability. I identified discontinuities by comparing labels across interviews, marking out repeated accounts of turning points and recognising changes in attitudes and expressed perspectives regarding mathematics practices. In the subsequent analysis, I focus on Isaac’s accounts belonging to the emergent theme perspectives on mathematics and its role in mathematics teaching. They provide evidence of identity development in terms of Isaac’s strengthened affiliation towards the practices of mathematics teacher education, yet, his struggles of realising his ambitions in own mathematics teaching.

The case of Isaac

In Norway, two university teacher education programmes qualify for mathematics teaching in secondary school (grades 8-13): a five-year Master’s programme in mathematics and natural sciences including teacher education (1), and a one-year, post-graduate teacher education programme (PPU) (2). In both (1) and (2), the students undergo longer periods of school placement in lower and upper secondary school, and they take courses in general pedagogy and mathematics education. Isaac comes from the latter programme, building on a Bachelor’s degree in chemistry
and about 60 ECTS credits in mathematics. I approached him to be a participant in the larger study based on his responses to a set of questions that was given to all last-year student teachers in mathematics belonging to either the five-year Master’s programme or the one-year PPU programme, within one Norwegian university. In addition to reporting that he planned to work as a mathematics teacher after graduation, Isaac ticked off “agree” on the statements “I perceive myself as a teacher” and “I perceive myself as a mathematics teacher”. After graduating from PPU, Isaac took a temporary position as a mathematics and science teacher at an upper secondary school, teaching mathematics and science within both the general education programme and the vocational education programme Technical and Industrial Production. Two weeks into his new job, he looks back at PPU and describes it as a positive experience. Isaac elaborates on a changed view on teacher education with terms such as becoming part of the way of thinking and mastering the language of a new discipline.

Isaac: I’ve liked that kind of studies, actually, much more than I had thought that I would like it because I’m used to solving problems with two underlines underneath the answer, and it was more fun than I thought writing papers [laughing]. (...) it has motivated me to think now I’m going to change the math classroom (...). And I feel that I have a lot of commitment, many things I would like to do, because of things I’ve learned in for example the math education lessons.

Isaac: After the first semester (...), I didn’t yet get the hang of it, mastering the discipline and its format properly (...) didn’t get the message of what we were learning and doing, as well as I did in the second period. Because then I was part of the way of thinking, then I kind of felt I had an eye-opener about how to work with the discipline, how to understand the discipline. (...) I got into the literature, and suddenly understood what all these authors wanted to tell, I understood the language, the way of thinking.

Isaac portrays teacher education as something that has turned out as more interesting and enjoyable than expected. He elaborates on his changed view by describing a difference between the first and second semester at PPU, from not “get[ting] the hang of it” and not “get[ting] the message”, to understanding “the language, the way of expressing (...) and thinking”. He tells about having an eye-opener into the language and mind-set of the teacher education programme, where the lectures provided motivation for “chang[ing] the math classroom”. To make the change of his mathematics teaching possible, Isaac has signed up for an in-service course in order to try out inquiry based mathematics teaching in his own classroom and share his experience with the other participants.

Isaac: I signed up for a course (...), the topic is inquiry based teaching, I chose a math project, in which I will try to, to a greater extent, inquiry, landscape of investigation, and see how it works, and try to break the instinct of standing and chanting at the blackboard. (...) Then I have committed myself to it through this project (...) so it becomes binding.
However, in an interview conducted three months later into his first year of teaching, Isaac accounts for an experience of stagnation when trying to change his mathematics teaching according to his ambitions. He struggles to find the resources for developing new activities, both in terms of having enough time to implement it and to getting the good ideas for inquiry based mathematics activities.

Isaac: I run dry of ideas when I’m supposed to find out how they can make the sign charts inquiry based. I’ve tried, but it has been a lot harder than I expected, to find these activities (...). Sometimes I’ve managed it (...) but not close to the amount that I wished for. I’ve done enough to meet the requirements of the in-service course, but I’m not able to do much more than that. I wanted a lot more. I have ambitions about doing more.

Instead of being a trigger for changing his teaching, the in-service course on inquiry based mathematics teaching has happened in parallel with Isaac’s classroom teaching. Yet, he still holds on to his ambition of changing his teaching practice in the future. Despite having a “way to go to get the right tools for it”, he imagines becoming a teacher who provides the students with a need to approach mathematics differently than seeking the one, correct answer on a series of tasks.

Isaac: I want to become the teacher who basically does two things. First of all, makes the students understand why, not knowing, but understanding, that’s my first ambition, and the second ambition is to be the one who makes you eager for knowledge. The one who makes you wanting to know, wanting to understand (...) and to reach that, I think I have to change the teaching in a way that students don’t get away with rattling off, or, they have to see the value in and the need of understanding. (...) I think I have a way to go to get the right tools for it.

In the final interview, taking place six months into his first year of teaching, Isaac voices a similar limited ability for establishing a different mathematics practice in the community of secondary mathematics teaching. Although he endeavours to invite the students into mathematics activities with no one, correct answer to the problems being posed, some of the students seem to hold on to their previous developed learning strategies. These students find comfort in solving textbook tasks with clear instructions, and they simultaneously avoid solving open problems that require a more flexible approach to the mathematics content. Isaac thus expresses lack of progress regarding his ambitions of teaching mathematics for understanding.

Isaac: What I’ve tried to do is not giving them access to the procedures so easily, meaning, the algorithms. I have tried to limit it, quite simply, the possibilities to memorise, not giving them any choice. And then tried to give them some open tasks, meaning, not a, b, c, d, which leads to something, but instead give them only d. But they don’t succeed. I don’t succeed, even if I try. If I only give them the task d, then I get kind of, resigned, almost tearful looks (...). Then I have to hold their hands the whole way, and I can never take off the support wheels.

The narrative analysis of Isaac’s accounts displays a story of overcoming a discontinuity regarding mathematics, its teaching and learning, when undergoing teacher education. Looking back at the PPU programme, Isaac explicates differences between university mathematics with its “two
underlines underneath the answer” and the imperfect and corrigible knowledge of the social sciences that were represented in teacher education. However, he also tells a story of expanding his perspectives on the practices of PPU, of changing his view on teacher education, its literature and modes of reasoning. His motivation for changing his mathematics teaching in line with what is communicated at PPU indicate thus an inbound movement within the practices of the teacher education programme. Due to his descriptions of having the need to change his teaching in direction of inquiry based mathematics practices, Isaac’s accounts further indicate inbound participation within a community of inquiry based mathematics teaching. He identifies with the community practices by exercising both engagement and imagination. The engagement involves signing up for an in-service course at his new school of employment, while imagination involves picturing himself as a future teacher who exercises mathematics teaching in line with what was communicated at PPU. However, Isaac also reports on a kind of conflict regarding the meaning of mathematics teaching and learning in the secondary mathematics classroom, which can be understood as the work of reconciling memberships across community boundaries (Akkerman & Bakker, 2011; Wenger, 1998). The reconciliation involves Isaac’s continued identification with practices in the community of inquiry based mathematics teaching, his and his students’ attempt of establishing a community of secondary mathematics teaching, as well as his students’ former memberships in communities of mathematics teaching and learning in previous schooling. Isaac’s attempt of establishing a meaning of mathematics teaching and learning in his secondary mathematics teaching is thus an issue of negotiability. Since the meanings that he and his students produce for mathematics are not only local and delimited by the classroom, different meanings compete for the definition of what mathematics teaching is or should be. Based on Isaac’s accounts, the meanings of mathematics teaching and learning stemming from the students’ previous mathematics practices seem to rule. He expresses limited ability to define what is appropriate regarding understanding in mathematics (understanding why, not only knowing what to do), with the consequence of being pulled away from his initial ambitions of exercising inquiry based teaching. Instead of establishing a new mathematics practice, the outcome is an ongoing conflict between him and the students regarding how mathematics should be taught and learned. Accordingly, Isaac gives descriptions of a limited ownership of meaning, in the form of undesired stagnation in his mathematics teaching practice.

Discussion

I have reported on the participative experiences of one individual mathematics teacher during his first year in upper secondary school. The study is based on the assumption that teacher learning is more than coming to know content, skills and practices. Rather, prospective mathematics teachers are active participants, who negotiate their experiences and create images of themselves and their challenging tasks and dilemmas in mathematics teaching (Carter & Doyle, 1996). Similarly, Sfard and Prusak (2005) claim that “human beings are active agents who play decisive roles in determining the dynamics of social life and in shaping individual activities” (p. 15). Developing a teacher identity thus brings with it “a sense of agency, of empowerment to move ideas forward, to reach goals or even to transform the context” (Beauchamp & Thomas, 2009, p. 183) in which mathematics teaching takes place. Although agency is not a term used by Wenger (1998), his
theorisation of identity as identification and negotiability has in this study provided a conceptual tool for gaining insight into Isaac’s ability and legitimacy to contribute to and take responsibility for the meanings that matter regarding mathematics teaching and learning in a secondary mathematics classroom. The results display some inconsistency between, on the one hand, his increased identification with mathematics teaching through inquiry, and on the other hand, his sense of negotiability regarding inquiry based mathematics teaching in the classroom. Identification with reform-oriented practices of mathematics teaching and learning is an important first step towards change and development of mathematics teachers’ practices. However, in order to explain further the possibilities for Isaac to develop his identity as a mathematics teacher in terms of changes in his practice, negotiability has appeared in this study as an important construct. Based on his accounts, Isaac seems to exercise imagination in a community of inquiry based mathematics teaching, by picturing a changed mathematics teaching practice. Yet, the results suggest that further participation by engagement, including active negotiation with other actors of a reform-oriented enterprise, is needed in order to alter the economy of meaning, and thus, to enable Isaac to implement the desired changes into his classroom teaching.

References
