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Pre-service teachers' future-oriented mathematical identity work

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Abstract Research on identity has been a growing domain in the contexts of teacher education and mathematics education; however, identity work has been explored to a much lesser extent, with a future orientation overlooked. In addition, earlier studies have not provided sufficient knowledge on how different elementary teacher education programs might facilitate pre-service teachers' identity work. In this study, we compare future-oriented mathematical identity work through a narrative framework considering six pre-service teachers undergoing two different teacher education programs. All pre-service teachers reported having had negative experiences with mathematics during their school years. Based on the results we conclude that despite the striking similarities in pre-service teachers' mathematical backgrounds, the ways in which these cases are conducting their identity work differ substantially. It seems that the main reasons for these differences are different emphases and pedagogical practices in mathematics education courses. Additionally, we further elaborate on our earlier conceptualisation of identity work.

Keywords Narrative identity · Mathematical identity work · Future orientation · Possible selves · Mathematics education · Teacher education

1 Introduction

During the last decade, identity has been analysed extensively in the contexts of teacher education (Rodgers & Scott, 2008; Kaasila & Lauriala, 2010; Beauchamp & Thomas, 2009) and mathematics education research (Black et al., 2010; Brown & McNamara, 2011; Kaasila, 2007a; Lutovac & Kaasila, 2011). Identity is seen as "who or what someone is, the various meanings people can attach to themselves, or the meanings attributed by others" (Beijaard, 1995, p.282). Identity work, however, has been considered much less frequently. As discussed previously (Lutovac & Kaasila, 2011), it has often remained broadly defined,

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especially in mathematics education. Furthermore, we see that in teacher education, identity and identity work revolve around the narrative aspect. The ways in which narratives shape and are shaped by identity are therefore of particular interest (cf. Beauchamp & Thomas, 2009). Narration is considered to be a major way in which people make sense of experiences, construct the self, and create and communicate meaning (Bruner, 2003). Accordingly, identity work here means the construction and reconstruction of meaning through stories over time (cf. Rodgers & Scott, 2008; Beijaard, Meijer, & Verloop, 2004).

Moreover, pre-service teachers' mathematical identity is here understood in terms of the narratives they create to explain themselves in relationship to mathematics and their mathematical lives (cf. Kaasila, 2007a; Connelly & Clandinin, 2000; Sfard & Prusak, 2005). Mathematical identity work therefore means narrating mathematical lives (cf. Watson, 2006). By focusing on identity work, this study continues and deepens the long Finnish research tradition of studying the beliefs, views towards mathematics and mathematical identities of pre-service teachers (see e.g., Hannula, 2007; Pehkonen & Hannula, 2004; Kaasila 2007a, b; Kaasila, Hannula, Laine, & Pehkonen, 2008; Lutovac & Kaasila, 2011; Kaasila, Hannula & Laine, 2012). We have earlier conceptualised mathematical identity work (Lutovac & Kaasila, 2011), however, the concept needs to be elaborated further.

The lack of future orientation when exploring teacher identity and reflection has been addressed in recent work (Hamman, Gosselin, Romano, & Bunuan, 2010; Urzua & Vasquez, 2008; Di Martino and Sabena 2011; Chapman, 2008). Understanding pre-service teachers' identities as narratives has mostly foregrounded past and present dimensions of identity (Kaasila 2007a, b; Black, Mendick, & Solomon, 2009; Drake, Spillane, & Hufferd-Ackles, 2001). However, we see that through narratives, pre-service teachers also verbalise their reflective future-oriented thoughts (cf. Urzua & Vasquez, 2008). Therefore, we aim here to analyse how pre-service elementary teachers are anticipating their possible future identities as mathematics teachers within their narratives (cf. Markus & Nurius, 1986; Hamman et al., 2010).

Earlier studies have not provided sufficient knowledge for the development of mathematics education courses. This study broadens the knowledge base by analyzing the identity narratives of six pre-service elementary teachers participating in two different teacher education programs in Finland and Slovenia. The study did not focus on cross-cultural comparisons, but instead compared the meaning of the pedagogical tools in the mathematics education courses. All pre-service teachers reported having had negative experiences with mathematics during their school years. Elementary teachers teach all subjects in grades 1–6; therefore they are non-specialists in mathematics. This further highlights the importance of gaining knowledge to facilitate these pre-service teachers' mathematical identity work.

2 Theoretical framework

2.1 Narrative mathematical identity

The concept of 'mathematical identity' (or 'mathematics identity') has been used variously in mathematics education (Black et al., 2010; Kaasila, 2007a, b; Sfard & Prusak, 2005). Here, we apply Ricoeur's (1992) concept of narrative identity, which is based on one's understandings of oneself across time that are accomplished by organising and clarifying one's temporal experience through narrative. Agreeing with Ricoeur (1992), the identity of the story makes the identity of the character. We thus define mathematical identity as narratives pre-service teachers tell themselves or others about themselves as mathematics

learners and teachers (see e.g., Drake et al., 2001; Kaasila, 2007a, b). These narratives carry various meanings pre-service teachers attach to themselves as mathematics learners and teachers, or the meanings attributed by others (cf. Beijaard et al., 2004).

Like personal identity, mathematical identity is multiple, shifting, and unstable, and has a (re)constructive, multi-contextual, relational, and emotional nature (Rodgers & Scott, 2008). We see narrative mathematical identity as a product of reflective processes: as such, it changes over time and is constantly under construction. Additionally, different contexts, situations, social relationships, and audiences influence mathematical identity (Kaasila, 2007a; cf. Ricoeur, 1992). Moreover, the concept of narrative identity is useful in that it explains how one can remain the same person despite life changes (Verhesschen, 2003). Narrative answering the question "who you are" is the unity (Ricoeur, 1988). For example, when pre-service teachers relate their narratives, the elements they chose to include or emphasize—such as particular learning or teaching experiences—often depended on whom they were addressing, e.g. a peer or teacher. While such narratives vary, they each contain a pre-service teacher's narrative identity (cf. Verhesschen, 2003).

2.2 Mathematical identity work

The stories people tell about school mathematics were investigated widely, and the relation of these stories to one's on-going identity construction was addressed (e.g., Drake et al., 2001; Kaasila, 2007a, Lutovac & Kaasila, 2010, 2011). We see that when pre-service teachers construct narratives from their mathematical experiences, they are doing mathematical identity work and thus constructing their mathematical identities. Therefore telling or constructing narratives is 'doing identity work' (Watson, 2006, p.525). As highlighted by Watson (2006), telling stories involves selecting, arranging, and reflecting on events in an artful manner, which contains meaning for the pre-service teacher and seeks to persuade the listener of its significance. To understand pre-service teachers' identity work, it is therefore important to know how they construct narratives from their experiences (cf. Singer, 2004), thereby, what they evoke out of their experiences in their plots and how. In this line, it is useful to understand the rhetoric used in identity narratives (Kaasila et al., 2012). For example, in one Finnish pre-service teacher's talk, Kaasila (2007b) identified 'self-development rhetoric'. This is a future-oriented talk with an optimistic connotation, describing one as an active actor with clear goals and it strongly relates to the idea of lifelong learning (Kaasila et al., 2012).

Earlier, we conceptualised mathematical identity work (Lutovac & Kaasila, 2011) as a narrative process including an interaction between the individual and the social mathematical context. It is a process of deep reflection and self-evaluation where past, present and future mathematical identities enter into a dialog that leads to one's awareness of a tension or gap between the actual and the ideal state of mathematical identity (cf. Kaasila & Lauriala, 2010, 2012). In our view, the presence of a gap is of key importance for evoking teacher change process. Finally, we see that identity work makes pre-service teachers able to cope with new situations in terms of their past experience and gives them tools to plan for the future (cf. Sfard & Prusak, 2005).

2.3 Future orientation: possible selves and anticipatory reflection

Ricoeur's framework suggests that temporality is acknowledged in narrativity. Accordingly, pre-service teachers do not limit their thoughts to the present moment. Their narrative mathematical identity is understood rather as extending to past and future selves (cf.

Ricoeur, 1992, 1988). Future identities in mathematics education research require further investigation (Chapman, 2008). A rare example in research literature is Sfard and Prusak's (2005) discussion on designated identity, which consists of "narratives presenting a state of affairs which, for one reason or another, is expected to be the case, if not now then in the future" (p.18). Here we consider future identities similarly. However, by applying the notions of *possible selves* proposed by Markus & Nurius (1986), we were able to examine pre-service teachers' future anticipations more broadly. Further, narrated possible selves, have been shown to be a rich source of identity information.

Possible selves were defined as views about what one *might* become, what one *would like to* become, and what one is *afraid* of becoming in the future (Markus & Nurius, 1986). For example, in spite of experiencing mathematics as difficult, a pre-service teacher might still *"want to become a good math teacher"*. Such future views about oneself can be very motivating. Additionally, because pre-service teachers in this study had encountered many difficulties in their past, their identity narratives are laden with emotions. The use of possible selves to understand their mathematical identities will permit us to capture a relationship between identity and emotions in terms of *hoped-for* and *feared* possible selves (cf. Hamman et al., 2010).

Because possible selves bridge the present and future, suggesting how pre-service teachers may develop (cf. Markus, 2006), we see possible selves as central when considering pre-service teachers' future-oriented identity work (cf. Dunkel & Anthis, 2001). Because possible selves are created within an individual's social and cultural context, they are also likely to be derived from what is valued, or perceived as valued within these contexts (Hamman et al., 2010). Similarly, Brown & McNamara (2011) discuss a multitude of "external demands" that form pre-service teachers' personal aspirations as well as their evolving teacher identities. The latter seems particularly useful when considering pre-service teachers' identity work in different educational contexts.

Finally, we see that pre-service teachers have possible selves upon which they can reflect (cf. Markus & Nurius, 1986). We agree with Beijaard et al. (2004, p. 122) that professional identity formation is also an answer to the question "Who do I want to become?", which is in line with Conway's (2001) anticipatory reflection. This future-oriented reflection or imagining future selves has been overlooked to date (Urzua & Vasquez, 2008; Chapman, 2008), despite the potential impact on pre-service teachers' development (Conway, 2001). Similarly, we see anticipatory reflection as important for identity work, particularly in the sense of establishing a goal or envisioning a future identity, such as possible selves or the 'ideal' self (Markus & Nurius, 1986; Lutovac & Kaasila, 2011). Furthermore, we see that when pre-service teachers' identity talk is future oriented, it reveals future-oriented reflection that projects a future identity (Urzua & Vasquez, 2008).

3 Methodology

3.1 Focus of the study

The focus of this study is to understand pre-service teachers' future-oriented mathematical identity work through a narrative framework. We address the following research questions:

1. In what kind of future-oriented mathematical identity work do pre-service teachers with negative view of mathematics engage during mathematics education courses?
2. How do different pedagogical tools used in mathematics education courses relate to pre-service teachers' future-oriented mathematical identity work?

3.2 Research persons

In 2009, the first author of this paper purposively chose 19 pre-service teachers as research persons for her dissertation: 6 pre-service elementary teachers were from the University of Lapland, Finland and 13 were from the University of Maribor, Slovenia. A negative view of mathematics that developed during a pre-service teacher's time in school was a predetermined criterion for participation in the study. The cases included were therefore rather homogenous (Patton, 1990). For this paper, we systematically selected three cases from each country for examination. First, we used a *critical case* strategy by selecting pre-service teachers who would contribute the most towards understanding and conceptualising the identity work. The cases selected make a point clearly, are particularly information rich (Patton, 1990) and expressed themselves vividly. Although we consider a limited amount of cases, logical generalisations are still possible in the sense of "if it happens there, it can happen anywhere" (Patton, 1990, p. 174). We also aimed at capturing the identity work that cuts across the cases within each educational context (Patton, 1990). Variations within cases in each context were little, however, they are different enough to illuminate the problem in a sufficient depth.

3.3 Data collection and analysis

The underlying premise of narrative inquiry is the belief that pre-service teachers' make sense of themselves and their world by telling stories (cf. Bruner, 2003, Ricoeur, 1988). We understand mathematical identity work as storytelling. We therefore need to study the process narratively (cf. Connelly & Clandinin, 2000). Moreover, narrative inquiry has been increasingly used to explore identity in mathematics education research (Kaasila, 2007a; Black et al., 2009). The narrative interviews (Mishler, 1986, Kaasila, 2007a) with pre-service teachers lasted 45–70 min. Confidentiality was assured, the purpose of the interview was explained and the relationship between interviewer and interviewees was established. The interview consisted in asking pre-service teachers to tell their life stories related to mathematics by using open-ended prompts. We also asked the following: "Tell me about your future as a mathematics teacher."

The narrative inquiry here involved analysing pre-service teachers' narratives in terms of content and form (Lieblich, Tuval-Mashiach, & Zilber, 1998, Kaasila, 2007a, b). We applied a categorical approach (Lieblich et al., 1998), focusing on how pre-service teachers anticipate their future as mathematics teachers and on commonalities within and between the groups. Each pre-service teacher's story was dissected; sections belonging to the 'future' category were separated for the analysis (Lieblich et al. 1998). The analysis was data driven in order to avoid projecting categories from one context to another. Systematic comparison yielded a common conceptual manifestation among pre-service teachers' narratives, which was labelled as future-oriented identity work. The contrasts between the cases led to the creation of two subcategories of identity work. The form was analysed by examining pre-service teachers' use of rhetorical questions, extreme utterances, disclaimers (Kaasila et al., 2012; Potter, 1996) and (in)coherence in their talk (Kaasila, 2007b). These gave additional information when understanding pre-service teachers' identity work. For example, pre-service teachers use *disclaimers* when they know that what they are saying may attract criticism (Kaasila et al., 2012).

4 The context

Pre-service teachers in both educational contexts receive a Master's Degree in Education. Further, in both teacher education programs, the following aspects are combined:

educational sciences, school subject disciplines, subject-specific didactics and teaching practice.

4.1 Mathematics education courses

Pre-service teachers Reija, Heli and Pia from the University of Lapland, Finland, took a mathematics education course in the second year of their studies. The course aims to develop students' views of mathematics (cf. Kaasila et al., 2008). Students' experiences from their own school years are handled through narrative rehabilitation and bibliotherapy. Narrative rehabilitation enables them to create meaningful narratives and to gain insight into their mathematical past and future (Lutovac & Kaasila, 2011; cf. Hänninen & Valkonen, 1998). Through bibliotherapy, the use of reading, they face affective changes, which may promote their development (Lenkowsky, 1987). Students also develop their mathematical understanding by exploring mathematical content with manipulatives. Collaborative work is emphasised. Students apply the knowledge from the course immediately upon completion in teaching practice.

Pre-service teachers Barbara, Ana and Ines from the University of Maribor, Slovenia, took three mathematics education courses. The mathematics content course, in the second year of their studies, focuses on basic mathematical concepts. In the first mathematics education course in the third year of the studies, students develop their mathematical understanding, explore mathematical content with manipulatives, and learn the methodological principles of teaching elementary school mathematics. One year later, the second mathematics education course prepares students for mathematics teaching by developing students' mathematical thinking. Collaborative work is emphasised. All courses aim to enhance the student's confidence in his or her own mathematical ability, knowledge and critical attitude towards school mathematics, and student's self-evaluation.

Through our experience in both mathematics education contexts, we identified the first context as having a more holistic or *humanistic identity-based* focus (Korthagen, 2004). This context helps pre-service teachers develop an identity and enhance their self-confidence in mathematics, and also gives special attention to how pre-service teachers undergo changes over time (Kaasila & Lauriala, 2010). The second mathematics education context is, in our view, more *competency-based* as it emphasizes pre-service teachers' knowledge, skills, and attitudes (Korthagen, 2004) while it does not consider their autobiographical contexts (Lutovac & Kaasila, 2010).

4.2 Pre-service teachers' background

Reija summarised she "never really liked mathematics" and thought "math was boring and you have to learn so much by heart." Reija strongly disliked teacher-centred teaching: "We just sat and listened to the teacher and did everything by ourselves. I didn't really learn that way." Reija's felt little motivation to study math: "I just didn't feel like I was good at it and I wouldn't even consider learning it more." Reija's self-confidence and participation in math classes worsened in secondary school because her classmates bullied her: "I tried to be as invisible as I could."

Heli's positive mathematical experiences changed in secondary school when the content became "too abstract" and she "didn't like it." Heli always thought of herself as "bad at mathematics", especially because she "was very good in every other subject." She lost interest and "just gave up." She did not feel supported by her parents because they "always thought that mathematics isn't so important." Heli's parents appear to have transmitted their beliefs to Heli, as she told she "began to think that way."

Pia summarised: "I didn't like mathematics, because I didn't understand what we were doing and our teacher didn't explain it well." For Pia "not understanding" influenced her beliefs about herself: "It's like I'm missing something in my brain." She experienced feelings of frustration and gave up on math. Pia did not identify herself as able to do math: "Mathematics is important, but also something that is for people whose work requires lots of mathematics. I only needed the basics, nothing else."

Barbara's difficulties in math were guided by a belief "I am not meant for mathematics." She was math-anxious: "It was like some fear would dominate over studying." Barbara's experiences worsened in upper secondary school due to her "bad teacher" and his negative attitude towards students: "I was afraid. He made fun out of things that someone didn't know, like 'you will not pass', 'there won't be anything out of you ever'." Barbara developed a negative view of mathematics and gave up on it: "I just thought it was a waste of time for mathematics."

Ana's experiences with mathematics were "very negative." Ana had difficulties understanding the content: "You see that you are not good at it and someone else gets it right away and you start asking yourself, 'How come I again don't understand'." Ana's motivation to do math was impaired: "I would find all the ways just so I wouldn't have to deal with math." Ana felt that her teacher viewed pupils negatively: "When she saw that you didn't study, she behaved in a despicable way. She always 'hit' you where it hurts the most."

Ines was affected by being compared with her older brother by several teachers: "I just knew I am not that good in mathematics. But the comments caused hatred." Ines's aversion towards math worsened due to a "bad teacher" and his negative attitude towards pupils: "He had comments like, 'If you don't know this, than you can go on the street or to some lower school and maybe you will be more successful there'." Ines summarised: "When I saw my math notebook, I felt like throwing up. I would never understand it."

We saw striking similarities in pre-service teachers' descriptions of their mathematical backgrounds. In line with our earlier studies, they all developed a negative view of mathematics (Kaasila et al., 2008). They perceived themselves as lacking mathematics ability and having low self-confidence in mathematics. They also perceived mathematics as difficult and reported that their learning motivation was impaired. In addition, they viewed the social context of learning mathematics as negative, with "bad" teachers as the most significant characters in their memories (Lutovac & Kaasila, 2011). Furthermore, they presented themselves as victims, especially in relations to the social context (Kaasila et al., 2012). For example, some felt mistreated by their teachers and/or classmates. Others described themselves as passive and having no control over what happened to them. Many dramatic and extreme statements marked these discussions.

5 Results

5.1 Present-future dialog: Anticipating future mathematics teaching

'Decisive' identity work

> I'm still quite afraid, but now that I have the experience of teaching math and it's positive, I have more confidence in myself too. So I will do well also later on. Of course I have to study very hard those things I don't know. I just don't want my students to feel they hate math and the teacher is boring. Again I have much…pressure for myself to do well. I know I have to try to study harder and I will do well, because I

want to be a good teacher in everything, in math too. My students deserve that I'm the best I can be. (Reija, Finland)

In the past, Reija had a tendency to view (mathematics) performance as highly important and had a difficult time accepting failure (Lutovac & Kaasila, 2010). Now her goal of wanting to become a good mathematics teacher, despite the challenges she has, also reflects her perfectionism. She finds a resolution in "studying hard." Reija's talk is decisive and an example of self-development rhetoric (see also Kaasila et al., 2012; Lutovac & Kaasila, 2010).

The tools used in the mathematics education course, such as manipulative models and collaborative work appear to have helped Reija: "The teacher of the course is very into those materials. We did things and we searched different kinds of information…from books and did group work, so it was good for me. I like the ways we are learning; it is more student-centred learning." Reija's emotional relationship with the subject did not change: "I still kind of don't like mathematics that much," but she is taking more mathematics courses: "But actually, I've decided to have one more mathematics course. So that I could learn more, because I have to teach it to pupils". Reija seems to understand her weakness—low mathematics ability in relation to the fact that she will have to teach mathematics eventually (cf. Phelps, 2010). Moreover, she initiates to develop herself to ensure successful mathematics teaching in the future.

It's not easy to teach, because they can ask amazing things that I cannot understand, for example, in the fifth and sixth grade there are some very difficult things to teach. But I can manage it. But I have to prepare myself for the lessons. The main point is that I want to teach that kind of mathematics that everyone understands. And I don't want it to be very abstract, because I think it's more important to understand the mathematics that is related to everyday life. (Heli, Finland)

Heli's talk is decisive; she knows what she wants for the future and therefore uses utterances such as "I can", "I have to" and "I want to". She articulates examples of how she would improve her future teaching. She wants to teach mathematics related to everyday life. She also uses self-development rhetoric; throughout her narrative, Heli explains how she is approaching mathematics in order to learn more. She emphasises the importance of preparation.

Heli described the mathematics education course she had taken as "very good, because we do things in groups and it gives me some ideas about how to teach children, not only the paper and the book like in the past". It seems that before the mathematics education course and her application of these principles in the teaching practice, Heli was "terified". She thought "I'm so bad in math, so I can't teach it." Heli is identifying with what she is rather than with what she is not by using a positive sentence to describe her low math ability (cf. Lieblich et al., 1998). The tight link between the course and the teaching practice changed Heli's view of teaching mathematics: "Now I think that it's a very nice subject to teach. Maybe I don't yet understand it, but I like it more. The wish to understand math better has led Heli to "enrol in more mathematics courses than earlier."

Well, I am still insecure. If I would have to go to teach mathematics for the sixth grade now… If I know what to do, then it's ok, but if I don't and I have to try to teach, then it's terrible. I have to do a lot of work for the preparation and I would like to understand. I would like to be as my fellow student is. I would like to have more skills for pupils. But I know that I'm not going to be like that, not in the same way. But

> I have to do lots of work, to understand mathematics and to give the knowledge to the students. It will be more difficult to teach math than other subjects. (Pia, Finland)

Pia wishes to be become as one of her fellow pre-service teachers, whom she sees as role models (cf. Markus & Nurius, 1986). Pia continues with a disclaimer, "But I know that I'm not going to be like that." to express her doubts that she will succeed. The latter shows Pia's pessimism towards reaching an 'ideal' (Kaasila et al., 2012), but she rises beyond it by finding a resolution: she wants to understand mathematics content well in order to teach it well. She recognizes she has to learn more, she has to "do a lot of work." This seems to be a motivating factor when investing the effort necessary for future success in teaching mathematics.

For Pia, the mathematics education course was "something really like new doors opening, like understanding that there really are different ways how you can do mathematics." She interpreted the past in the light of the present: "I couldn't do mathematics and it's because I've been thinking about those rules and theories but it's more. There are different paths to the result." Additionally, Pia refers to the narrative rehabilitation (Lutovac & Kaasila, 2011, 2013) applied during the course, through which she "understood that there are other people who don't understand so well." This encouraged her to think she "could go deeper in mathematics" to ensure her future success as a teacher (Phelps, 2010).

'Irresolute' identity work

> I am afraid sometimes of mathematics. How I will teach it at all, if I don't understand. How will I be able to explain so that someone else would understand? This is what I am most afraid of now regarding the future. Just how will I explain the issue at hand, if I don't understand it myself? (Barbara, Slovenia)

Barbara poses many rhetorical questions in her talk. She focuses on fears for the future but does not rise beyond them to reach conclusions. Barbara continued by saying: "If I don't understand something, because I didn't learn it when I should have, I am afraid I will not be able to pass the necessary knowledge on to pupils." Barbara does not anticipate addressing her weaknesses and seems to remain indecisive.

Barbara told about a mathematics education course: "You can really see they [the teacher educators] try to make us think on our own, like 'how would you teach this to pupils'. That is really great to think about!" Despite Barbara's enthusiasm towards the didactical aspect of the course, as seen in the upper future-oriented data excerpt, she is insecure regarding how she will explain the content to pupils. Barbara knows well what kind of teacher she will avoid becoming: "I know I will not be as my teacher that made my life miserable." But it seems that she cannot offer a concrete view about what kind of teacher she would like to become. It seems that Barbara's prior experiences are dominant in her future-oriented identity talk: "I want to forget what happened." This shows that she did not distance herself from her negative past and makes it harder to have a clear vision of her positive future self.

> Horrible! If I have to teach lower grades ok, but if higher, I am actually afraid. I am really afraid, because I know that I have big deficiencies in mathematics, big deficiencies in how to explain to someone as concretely as possible, so that they will understand. This is my fear; that I will not teach math so well. Because I don't master it. I don't picture myself right now as a teacher, because I don't see myself ready to stand in front of pupils. I am lost! Because you know that you aren't ready so they will put you into some environment, and you know that you have responsibility towards all those little ones. (Ana, Slovenia)

Ana expresses many fears by using extreme utterances such as "big deficiency" (Kaasila et al., 2012) but does not say anything about her future expectations. Further, it seems that Ana is not yet ready to become a teacher. She discusses her insecurity; she generalises her feelings with the use of second-person singular pronoun "you", implying that other pre-service teachers might feel similarly uncertain. It seems that the mathematics education course left her indecisive by raising doubts about her competence in teaching mathematics.

Ana experienced mathematics courses as "really negative." Ana considers elementary teachers as more powerful than those at the university: "She showed us everything, also the things that are not so closely connected to mathematics didactics. These things are important. These teachers here [teacher educators] don't teach us that. They should warn us about mistakes that are done in practice and how to teach something." Ana still seems to blame others (e.g. teachers) for her challenges rather than finding a resolution to them and move on.

> We have such a little amount of teaching practice that I am a bit afraid. If you put me in the classroom, I don't know how I would manage. I have a feeling, that I don't have the ideas. But on the other hand you can ask for help and you have this teacher's guidebook. I would somehow manage. They already expect something from you, but I think it will go. I would like to teach more in the first three classes; because I think it fits me better and there are a lot of things on the concrete level. You just have to have ideas and different ways to explain the things. This is not mathematics of drill and equations. So I am not that afraid. (Ines, Slovenia)

Ines's future-oriented talk appears quite incoherent (Kaasila et al., 2012) as evident in the following pattern of her utterances: "I don't know how I would manage…", "But on the other hand…I would somehow manage…", "how will I manage…" and "but I think it will go." Ines's views are opposing and mutually exclusive, as well as shifting between negative and more optimistic views towards the future. For example, she first says she lacks ideas for how to teach math; later, she says she could teach math in lower elementary classes. This incoherence in our view suggests Ines's uncertainty regarding the future (cf. Urzua & Vasquez, 2008). We see there might be unresolved issued that prevent her from having a clear future vision (Lutovac & Kaasila, 2013). Additionally, Ines's talk does not include concrete examples of what kind of mathematics teacher she would like to become. She seems to anticipate teaching in a traditional way (e.g., teacher's guidebook-driven instruction) as a future-oriented coping strategy.

During the mathematics education course, Ines found a new perspective on what mathematics is: "you don't think anymore that mathematics is some drill, equations, but you start thinking how to explain this to pupils and how was this explained to me and this I wouldn't do like that. I perceive mathematics totally differently". It seems Ines started seeing mathematics through the lens of teaching. Ines says, "I think I got a positive feeling about mathematics"; however, the past memories continue to invade her thoughts: "Even though when I think of mathematics, I still remember. It is still in me and I just don't know how to erase it." Ines's identity talk implies she wants to forget those memories; however, she does not know how to achieve this. Also Ines failed to distance herself from the negative past (Lutovac & Kaasila, 2013).

5.2 Comparing pre-service teachers' mathematical identity work

Pre-service teachers' future-oriented narratives may appear similar but actually convey different stories. *Decisive cases* anticipate the future clearly and exactly. These pre-service teachers expect to reach their possible selves. In their talk, they seem to balance their expected and feared possible selves: between how they want to become and how they do

not want to become. Similarly, Markus and Nurius (1986) argued that people imagine selves that they would like to achieve as well as those they would prefer to avoid. Because these pre-service teachers' balance their positive (expected and hoped-for) and negative (feared) possible selves, their identity talk expresses motivation (cf. Markus and Ruvolo, 1989). *Irresolute cases* however anticipate the future more anxiously and with uncertainty. This was manifested through the incoherent nature of their talk as well as frequent use of the utterance *"I am afraid"*. Too many expressions of uncertainty may signal that the pre-service teacher is struggling (Urzua & Vasquez, 2008). These cases also contained little evidence of clear goals. Their possible selves seem to be less elaborated; feared possible selves are dominating over hoped-for or expected possible selves. This suggests less balance between positive and negative selves and a sense of helplessness (cf. Markus & Ruvolo, 1989).

All cases exhibited tension due to the low perceived mathematics ability and it being potentially hindering for the future teaching. However, the two groups of pre-service teachers seemed to handle this tension differently. *Decisive cases* found a resolution in learning to become a mathematics teacher: They felt that they needed to understand mathematical content in order to eventually be able to teach it (Phelps, 2010). Their identity work was labelled as 'decisive'. *Irresolute cases* experience a similar tension; some also doubt their competence in teaching mathematics. However, they neither draw conclusions nor make decisions. Their future-oriented identity talk remains full of fears and indecisive. They seem to lack agency to learn for their future profession. Therefore, their identity work was labelled as 'irresolute'. The resolution is thus essential for understanding the difference between two types of identity work as pre-service teachers responded to tensions and future related fears differently. The *decisive cases* chose to rise above their fears and insecurities, whereas the *irresolute cases* seemed submitted to their fears. For example, *decisive case* Pia, whose views were to a certain extent pessimistic, was still willing to invest extra effort in order to secure a future benefit. *Irresolute case* Ines, whose talk may resemble Pia's, does not show the similar agency.

6 Discussion

We identified two types of future-oriented mathematical identity work: *decisive* (characterised by goal directedness and balance between possible selves, with a strong emphasis on learning and self-development) and *irresolute* (characterised by the absence of clear goals, an imbalance between possible selves, uncertainty and helplessness regarding the future). Due to the similarities in pre-service teachers' mathematical backgrounds, the difference in their identity work was a surprising finding. Further, although some variations emerged within *decisive* and *irresolute* cases, each type of identity work was identified belonging to one or the other educational context. It seems that the main reasons for these differences are different emphases and pedagogical practices in mathematics education courses. Moreover, the observation of *decisive* identity work suggested there might be tools to facilitate positive shifts.

Unlike the *irresolute cases*, the *decisive cases* had taken the course that explicitly addressed identity development. This course enhanced pre-service teachers' views of mathematics through narrative tools that addressed school time memories: narrative rehabilitation and bibilotherapy (Kaasila et al., 2008; Lutovac & Kaasila, 2011). Based on the data, most pre-service teachers' negative possible selves (e.g. feared selves) seemed closely related to their negative pasts as pupils. When emotion-laden memories persisted in pre-service teachers' thoughts, their feared selves became dominant and they lacked strategies to escape those selves (Markus, 2006). This prevented pre-service teachers from coping with the future. Therefore, the lack of will to move forward or reach goals can be seen as related to

the existence of well-elaborated negative possible selves, which was evident in *irresolute cases*. However, when pre-service teachers' school experiences were addressed, they gained insight into their mathematical past, present, and future (Hänninen & Valkonen, 1998; Lutovac & Kaasila, 2011). Further, the *decisive cases* were able to distance themselves from the past, allowing the elaborated possible selves to motivate them and focus their activities in a goal-directed manner. The agency evident in these cases is linked to their identity work.

Therefore, we note that narrative tools that address school memories are important for pre-service teachers' identity work (Kaasila et al., 2008; Lutovac & Kaasila, 2011). These tools help pre-service teachers deal with specific negative aspects of their pasts and orient to future challenges. Such efforts may further promote *decisive* identity work. Conversely, when pre-service teachers were not given the opportunity to deal with their recollections, they were unable to make more conscious choices (Korthagen, 2004) and rendered indecisive. Moreover, the meaning of narrative tools was evident in the changes in pre-service teachers' talk: the *decisive cases'* talk no longer reflected feelings of being a victim. Rather, they used *self-development rhetoric*: the talk about how to improve as a teacher. Kaasila et al. (2012) noted similar changes and suggested that mathematics education courses that included students' autobiographical context promoted self-development rhetoric. We see self-development rhetoric as a central aspect of *decisive* identity work. Such rhetoric was not identified in *irresolute* cases.

The notion of possible selves (Markus & Nurius, 1986) was especially useful for understanding future-oriented mathematical identity work. Elaborating on our earlier conceptualization (Lutovac & Kaasila, 2011), we see that pre-service teachers may anticipate their future through ideals, expectations, and even fears. Therefore, the pre-service teachers' development can be seen as a process of acquiring and then achieving or resisting certain possible selves (Markus, 2006). This identity work can be seen as either closing the gap between the present selves and positive possible selves (e.g., expected, hoped-for, ideal selves) or increasing the gap between the present selves and negative possible selves (e.g., feared selves). We note the role of agency here. We understand agency as the pre-service teachers' will and ability to develop distinct possible selves (Markus & Nurius, 1986). The role of agency becomes evident in the extent to which possible selves are associated with strategies to achieve or avoid (cf. Hamman et al., 2010). Additionally, pre-service teachers were identified as active agents in their identity work when acting toward the future by creating continuously new possible selves (Sfard & Prusak, 2005). The focus on identity (or lack thereof) in mathematics education courses is important, as a pre-service teachers' awareness of their identity may result in a sense of agency (Beauchamp & Thomas, 2009).

We are aware of the limitations of our cases in the effort to elucidate pre-service teachers' identity work, particularly because we considered only a few cases, all of whom had a negative view of mathematics. We are likewise aware that the results might pertain explicitly to the teacher education contexts in question. Thus we did not attempt to generalise our findings to all pre-service teachers in particular settings or widely. The six cases here are solely illustrating mathematical identity work in which pre-service teachers with a negative view of mathematics may be engaged during teacher education. Finally, we emphasise that our aim is not to praise 'humanistic identity-based mathematics education contexts' and criticise 'competency-based' contexts as we are aware that the results could have been different had the study focused on the competency. We only want to highlight that, regardless of their different foci, mathematics education courses should address identity work overtly while preparing pre-service teachers for the future teaching (Beauchamp & Thomas, 2009; Brown & McNamara, 2011). As much as pre-service teachers' negative view of mathematics seems to be an issue; *irresolute* identity work is in our view an even bigger concern, especially at the end of the studies.

We therefore present the following careful recommendations. First, pre-service teachers should be assisted in balancing positive (e.g., expected, hoped-for) and negative (e.g., feared) possible selves to increase their confidence in the future (cf. Urzua & Vasquez, 2008). Therapeutic narrative tools (Lutovac & Kaasila, 2011) are one way to facilitate resisting negative possible selves. Additionally, we agree with Urzua and Vasquez (2008) that pre-service teachers' future-oriented talk is an essential part of their identity work, in which they should engage during teacher education. Anticipatory reflection should thus be promoted in the context of mathematics education (Chapman, 2008). In our view, the construction of identity narratives will also promote reflection upon the future and will enable pre-service teachers to imagine themselves as mathematics teachers.

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