Linnaeus University Dissertations
No 370/2020

Andreas Ebbelind

Becoming recognised as mathematically proficient

The role of a primary school teacher education programme

LINNAEUS UNIVERSITY PRESS

Becoming recognised as mathematically proficient

The role of a primary school teacher education programme

Linnaeus University Dissertations

No 370/2020

BECOMING RECOGNISED AS MATHEMATICALLY PROFICIENT

The role of a primary school teacher education programme

ANDREAS EBBELIND

LINNAEUS UNIVERSITY PRESS

Becoming recognised as mathematically proficient: The role of a primary school teacher education programme
Doctoral Dissertation, Department of Mathematics, Linnaeus University, Växjö, 2020

ISBN: 978-91-89081-16-1 (print), 978-91-89081-17-8 (pdf)
Published by: Linnaeus University Press, 351 95 Växjö
Printed by: Holmbergs, 2020

Abstract

Ebbelind, Andreas (2020). *Becoming recognised as mathematically proficient: The role of a primary school teacher education programme,* Linnaeus University Dissertations No 370/2020, ISBN: 978-91-89081-16-1 (print), 978-91-89081-17-8 (pdf).

This study focuses on upper primary prospective teachers in their first years of a teacher education programme in Sweden, in particular, a 20-week mathematics education course. It aims to contribute with insight into how, or even if, experience from a teacher education programme and other relevant past and present social practices and figured worlds plays a role in prospective generalist teachers' imaginings of themselves as primary mathematics teachers-to-be and potentially shapes their identity. The theoretical perspective, Patterns of Participation, guides the logic and the research process and is used to interpret the construct of professional identity development. Ethnographic methods were crucial during the research process, which starts by taking a wide perspective on relevant social practices and then focuses exclusively on the everyday lives of prospective teachers.

This study adds to the understanding of how the similarities in the discursive patterns of two prospective teachers, Evie and Lisa, frame their processes as teachers-to-be by staying committed to their prior positive experiences of mathematics. The figured world of performative mathematics is a significant aspect of Evie's and Lisa's experience, which involves being recognised for mathematical ability. Evie's identity development is framed in relation to how her degree of certainty changes during her teacher education experience. She became recognised as someone who helps others in mathematics and found a way of performing this role during the teacher education programme. Lisa's identity development is framed in relation to her commitment to the figured world of performative mathematics. She became recognised as a winner of competitions and for quickly completing the textbook exercises – experiences that proved formative during her teacher education programme.

In this study, I conclude that the teacher education programme has an impact regarding prospective teachers' professional development, but perhaps not in the way teacher educators expect or want. Thus, the teacher educators' intention for the education programme differs from the result. An important aspect is that prospective teachers are not challenged first and foremost by encountering the theoretical perspectives involved in teaching mathematics. Instead, their prior experience is confirmed when used as a key source in determining what teaching mathematics means in terms of identity.

Keywords: mathematics education, teacher education, primary school, prospective teacher, identity development, Patterns of Participation, ethnography.

Acknowledgements

This is how it all begins: Evie and Lisa are admitted as prospective teachers, and they are to start a teacher training programme. They are teachers-to-be. This study is about them. They both have chosen to become upper primary teachers because they "simply love" mathematics. However, apart from the preference for mathematics, they have decided to study the teacher education programme for very different reasons.

Evie, 2 September 2011

> I have always liked children and always been interested … I have always wanted to become a teacher […] I want to mention that I have been adequately informed of how it is to be a teacher … because both my mom and my aunt are teachers, I know what I engage in.

Lisa, 31 August and 27 September 2011

> I did not know what I wanted to be, and I still do not know. Then I was at a school and had practice, and it was there the idea came. However, as I said I still do not really know. [...] I thought teacher training would be a little easier than this. You have of course heard from various people that everyone would pass and no one will fail. That was why I chose it too. That is, if you have nothing to do, you can always be a teacher.

This study is about Evie and Lisa. It is about their lived experience of attending a teacher education programme in general and a mathematics teacher education in particular. However, it is also their lived experience from other places that influence their development as upper primary mathematics teachers.

During this process, I began to view Evie's and Lisa's process of developing a teacher's identity differently. The complexity that emerged has stunned me, as Evie and Lisa have re-engaged in their past school experience and re-formulated their future teaching while moulding their prior experience with present experience from their teacher education programme and other social practices. How their past and present experiences have moulded, fused, merged, changed, excluded or included different ways of conceptualising teaching and learning has made me aware that developing as a teacher is not a one-way track. Rather, the process is like a train network where hundreds of trains head towards the central station. The problem with this analogy is that the central station is situated differently in relation to each prospective train even though we pretend that it is in one exact location. However, the railway tracks sometimes cross each other and share similar surroundings.

Thank you, Evie and Lisa, for sharing this experience with me – and from here, it will also be shared with others. You have contributed with so much insight.

Dear Jeppe Skott, you, your work and your support have contributed to this understanding. Thank you so much for letting me do the thesis I wanted and for challenging me on the way. Without you, I would probably not have considered or known myself to be capable of writing this kind of thesis. I owe you my gratitude.

Dear Despina Potari, thank you for valuable support when I doubted myself the most. Like Jeppe, you always seem to ask the right questions. Annika Andersson, thank you for pushing me in the right direction at the 50% reading. Constanta Olteanu, thank you for encouraging me, in the beginning, to not let go of Systemic Functional Linguistics, even though you implied that it was too complicated for a doctoral student in mathematics education. Tamsin Meany and Ewa Bergh-Nestlog, thank you for all the hours you have given me of your understanding of Systemic Functional Linguistics.

This research education is coming to a close, and this thesis is the artefact that symbolises both an end and a new beginning. This thesis is therefore not just a thesis about Evie and Lisa developing an identity as upper primary mathematics teachers, but rather it is a part of my life journey. As a side note, life has gone by: joyful moments and sadness have been embedded in the years that I now leave behind. In the years to come, I look forward to becoming a better husband and more joyful father. Thank you, Eva, Isak, Alva, and Sigge for being there

to light up my life, even though I may not have been that sparkling from time to time.

People around me during this research education process often told me that a research education makes you change as a person. Indeed, this is the case. How I experience the world today is not the same as before. The way I participate with others is not the same as before. The way I engage in discursive arenas is not the same as before. I experience other people differently than before. I listen to others differently than before. I interpret how they talk, or not talk, differently than before, and I am more aware of how I speak with others. In this confusing process, it is nice to know that I am surrounded by a lovely family and colleagues that care.

Thank you, Hanna Palmér, Helena Roos, and all the others for being there in the corridor day after day. Thank you, Cecilia Segerby – your friendship during this process has meant much to me.

Introduction

This study is situated within the project, *The makings of a mathematics teacher*, led by professor Jeppe Skott at Linnaeus University in Sweden. The overall aim of *The Makings* was to make visible, interpret and describe the development of mathematics teachers in teacher education programmes and the first few years after graduation. Within this project, Palmér (2013) and Skott (2015), among others, focused on newly educated teachers and their transition from university to working as a teacher.

This study focuses on upper primary prospective teachers in their first years of a teacher education programme, and in particular, on a 20-week mathematics education course. More specifically, the focus of this study relates to the process of developing a mathematics teacher identity as an upper primary, generalist, prospective teacher who will teach mathematics among other subjects. The upper primary teachers in my study will go on to teach children from ages ten to twelve (see Fig. 1).

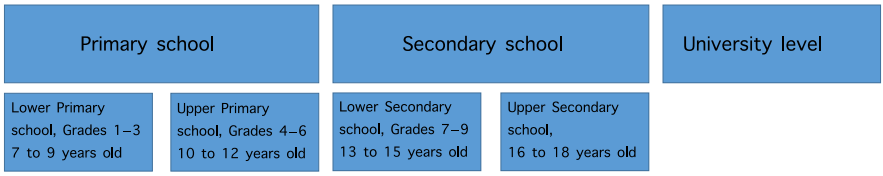

Fig 1. A schematic overview of the Swedish school system.

The importance of the concept of identity has increased in research during the last 20 years (Darragh, 2016; Morgan, 2012; Palmér, 2013; Skott, 2015). The concept of identity allows the researcher to focus on either individual identities or community identities, or both (Bjuland, Cestari & Borgersen, 2012). Further

information about identity is presented in the literature review (see the section, "Identity development", p. 38).

I use the notion of identity to describe a process that happens during a teacher education programme and to illustrate how prospective teachers use past and present experience when talking about mathematics, mathematics education, and their future teaching of mathematics. In this study, the prospective teachers become the primary focus and of special interest is how they negotiate and renegotiate their school-related experiences during their teacher education programme.

This specific interest draws on the recent concern in the school subject of Mathematics that generalist primary teachers within their first years in the profession may not prioritise or may have no opportunity to prioritise (Palmér, 2013). As a teacher educator, this phenomenon became most interesting to me. I grew interested in prospective teachers' identity development during the teacher education programme and started asking questions about how they imagine their future mathematics teaching:

- What do prospective teachers emphasise as crucial in their teacher education experience, and how do they experience situations arranged by teacher educators in general and mathematics education educators in particular?
- How do prospective teachers in these situations prioritise the content taught at the mathematics education course at the university?
- Do prospective teachers want to prioritise the content taught at the mathematics education course at the university, or do they prioritise other things than what seems to be expected from the teacher educators' point of view, and in that case, why?
- What is important or relevant from prospective teachers' points of view when attending the teacher education programme in general and courses in mathematics education in particular?

These general questions framed the research interest from the very beginning.

The study focuses on two prospective teachers who were chosen for specific reasons. I had no intention of aligning with the current discussion about prospective teachers' lack of knowledge in mathematics or prospective teachers' lack of interest in mathematics (Sowder, 2007). Before I began my

research education, I had already read research articles that point out prospective teachers' lack of knowledge and lack of interest concerning mathematics. This topic has been the subject of many discussions at gatherings of teacher educators around Sweden.

However, I reasoned with myself and felt sure there must be prospective teachers attending a primary teacher education programme who were both interested in mathematics, and from those teacher educators' point of view, also knowledgeable in mathematics. As a teacher educator, my own experience made me aware that they do exist. I began to ask myself how these prospective primary teachers who were interested in mathematics experienced the courses in mathematics education.

At the beginning of the study, I realised that prospective teachers have different agendas when attending courses in the teacher education programme. Quite early on in my research education, I realised there may be experiences other than solely participating in the teacher education programme and the mathematics education courses that are important for how a prospective teacher develops as a mathematics teacher. Palmér (2014) asks if the research community is receptive enough to prospective teachers' interests and educational agendas. That is why it was important for me not to restrict this study to the teacher education programme alone but rather to open up for all the experiences that contribute to the development of a mathematics teacher's identity.

Quite early on in the research education, the process of developing a teacher's identity seemed increasingly more complex and exciting, and it caught my interest. It was so compelling that to make visible, interpret and describe this identity development process became the primary focus of this study. It was important for me to get a sense of how prospective teachers participate in the teacher education programme.

Initial aim of the study and research questions

In line with this introduction, the overall aim of this study is to contribute with insights about how, or even *if*, the experience from teacher education and other relevant past and present social practices matter to prospective generalist teachers' imaginings of themselves as primary mathematics teachers-to-be. Social practice is conceptualised as a collective way of being – a specific social

interaction (Fairclough, 2010) with a common endeavour (Wenger, 1998). In relation to such a collective way of being, the study focuses on how the prospective teachers elaborate on their own experiences. In correspondence with the overall aim, I have outlined three research questions as important:

- What experiences from the teacher education programme and other relevant social practices are visible in the prospective teachers' own tales of themselves as teachers-to-be?
- How are these different experiences related?
- How do the prospective teachers' tales of themselves as teachers-to-be develop during parts of the teacher education programme?

The teacher education programme – The setting of the study

In this section, mathematics teacher education will be briefly introduced, first from an international perspective, secondly from a Nordic perspective and finally from the perspective of the actual teacher education programme where the study is conducted. The last part is important in two different ways. First, it introduces the institutional setting of the study, and secondly, it becomes important in relation to the analysis of the gathered information.

International outlook – Primary teacher education

Expectations on teachers seem to increase worldwide in the light of different educational tests that compare countries with each other, for example, Programme for International Student Assignments, PISA, and Trends in International Mathematics and Science Studies, TIMSS. These changes in expectations have led to the fact that previously autonomous teacher education programmes in different countries have started to imitate each other, both nationally and internationally (Tatto, Lerman & Novotná, 2009).

In this landscape, Tatto et al. (2009), through their metaperspective, view four ways of structuring mathematics education for primary teachers at the national level. First, there are teacher education programmes that put a high value on the knowledge of mathematics as a subject. The reason for this is because they regard high proficiency in mathematics as necessary for teaching in primary years rather than extensive knowledge of the teaching profession. Secondly,

others emphasise the mathematics pedagogy instead, aligning with the view that teaching mathematics requires another understanding of mathematics than the subject itself. There is specific knowledge related to teaching mathematics. Third, there are some educational systems concerning primary teacher education programmes that primarily emphasise general pedagogy. However, according to Tatto et al. (2009), they miss the link to the subject and are criticised by the mathematics education research community. Fourth, the last way of looking at mathematics education for primary teachers at the national level is to emphasise the link to internship experiences as increasingly important. The learning potential of fieldwork recognises this. However, as emphasised by Tatto et al. (2009), the kind of learning that emerges from the internship is not always the one the teacher education community expects (see chapter 2, Becoming a teacher during teacher education, for an elaboration).

In this sense, the role of teacher education programmes in the educational system is discussed and problematised increasingly more, both in Sweden and internationally (Jansson, 2011; Hošpesová, Carrillo & Santos, 2018; Philipp, 2007; Sowder, 2007). Tatto et al. (2009) make some remarks concerning general trends that can be viewed in the world related to these four ways of structuring mathematics education for primary teachers at the national level.

One point is that the subject domains are increasingly more emphasised even within primary teacher education programmes. There is a worldwide trend of primary teacher education programmes being offered at universities instead of being located at so-called teacher education colleges. Tatto et al. (2009) conclude that the high focus on mathematical knowledge in secondary teacher education programmes is therefore slowly transmitted downwards without questioning any consequences. Also, another growing concern in many university settings is the lack of pedagogical content knowledge in relation to primary teacher education.

Another stressed matter, indicated at the beginning of this section, is that teacher education programmes are slowly being increasingly more regulated on the national level. The fact that some politicians view prospective teachers as not knowledgeable and view teacher education programmes as not sufficient enough draw attention to the subject domain itself. Politicians also share a more traditional view on teaching than teacher educators tend to promote (Tatto et al., 2009).

On the contrary, outwith the political agenda, there is a consensus among researchers in mathematics education that the teaching that is promoted concerning primary mathematics education should fall in line with the reform mathematics movement (Sowder, 2007).

> [T]he reform [mathematics movement] promotes a vision of school mathematics that focuses on students' creative engagement in exploratory and problem-solving activities as they develop their understandings of significant mathematical concepts and procedures. (Skott, Mosvold & Sakonidis, 2018 p. 164)

The reform mathematics movement points out specific aspects of teaching mathematics which set it apart from "traditional" teaching. Reform mathematics and traditional mathematics are general explanations of how education is conducted within classrooms. In these classrooms, the traditional teaching can be contrasted to the reform-oriented teaching and regarded as figured worlds as in the study of Ma and Singer-Gabella (2011). Figured worlds is to be understood as collective as-if worlds that shape and are shaped by situated participation. (Figured worlds as a notion is explained in chapter Theoretical directions and concepts)

> People, actors in the figured world, have expectations for how events unfold and how others will behave in these events. The figured worlds of both traditional mathematics pedagogy and reform pedagogy are peopled with children, teachers, parents, other faculty in the school, administrators, curriculum developers, and so forth; however, the similarities end there. Although the general outcome of "learning" is valued in both worlds, the specifics of what constitutes learning and its indicators differ. The responsibilities and relationships between teachers and children differ as well, as do the significance of problem solving and the routines of classroom activity. (p. 9)

Situating the Swedish teacher education

The political agenda, the trends elaborated on in the former section, and the reform mathematics movement are described as international phenomena. If one compares the teacher education programme in Solomon et al. (2015) that relates to a Norwegian setting and the teacher education programme in Hemmi and Ryve (2015) that relates to a Swedish/Finnish setting, one can detect

patterns that are in common with the kind of teaching conducted in teacher education in Sweden described in Palmér (2013) and Skog (2014). In my interpretation, that means that the teacher education programme described in this study resembles many other teacher education programmes, both internationally and from a Nordic perspective. In this sense, this study also relates to an international perspective, research agenda, and discussion.

In Sweden, the political establishment (Björklund, 2011), teacher trade union (LR, 2009, 2016 LT, 2012), Ministry of Education and Research (Utbildningsdepartementet, 2010, 2014) and media (SvD, 2010) are all interested in teacher education. The primary reason for this is their concern that simply everyone who wants to become a teacher can enter a teacher education programme due to the low admission criteria. Another concern is that teacher education, from their point of view, fails to prepare prospective teachers for their future. In their view, teacher education programmes need to educate teachers who are more knowledgeable, and it would be desirable if the admission points were higher, thus guaranteeing that students with very low grades will not be admitted to the programme.

Most prospective teachers in Sweden have just ended their upper secondary education when they enter the programme. Teacher education in Sweden does not have the prerequisite of university studies before entering the programme.

Current Swedish teacher education has its roots in two different educational traditions: the seminar tradition and the academic tradition. The seminar tradition was realised to prepare prospective teachers to teach children from a low social-economic background and can be traced back to the mid-1800 (Beach, Eriksson & Player-Koro, 2011). The second tradition involves the academic disciplines that were already in place in 1724 to teach prospective teachers to teach older children from a high socio-economic background.

The teaching of teachers in the seminar tradition was performed in smaller groups where the participants shared their experiences with each other. It was regarded a vocational training where teacher candidates slowly learned the craftsmanship involved in teaching. This can be regarded as a methodological focus on teaching that can be viewed as a practical orientation, setting out to illustrate how one arranges the learning environment for the students. The primary focus of the seminar tradition was on the methodological aspects of teaching and questions of morality. Teachers were meant to teach children to behave appropriately, and subject knowledge was not regarded as necessary for

the type of children that the seminar tradition set out to educate. This is the reason why the seminar tradition usually focuses on the practical aspects of teaching and has primarily been based on what is known as practice-oriented knowledge. In contrast, the academic tradition focused more on the specific subject itself. While the seminar tradition was regarded as a vocational training, the academic tradition was regarded as an academic education conducted in a university setting (Beach et al., 2011).

The clear distinction between the seminar tradition and the academic disciplines are not solely a Swedish phenomenon. Bernstein (2000) emphasises that these traditions and distinctions are international and can be found in many different countries. However, in Sweden, there has been an endeavour during the last 40 years to unite these two traditions into what is called a common core education, where both these traditions are visible. This led to an official report (SOU, 1999:63) that proposed one united teacher education programme (Lindberg, 2011).

Beach et al. (2011) generalise and explain that teacher education programmes related to primary school in Sweden have a history of aligning more with the seminar tradition, whereas secondary school has generally been conducted within the more academic tradition. However, due to the merging of the two traditions, the two branches were expected to inform one another. The combinations of these two traditions were intended to generate "better" teachers in the future. The focus was on improving the primary school teachers' knowledge of mathematics and also giving the secondary school teachers more teaching skills related to the teaching of mathematics. Beach et al. (2011) conclude that this reform changed the way Swedish universities and colleges arranged programmes for teaching at teacher education for primary school. It became a more academic education and less practice-oriented.

What mathematics teacher educators think is important

Hemmi and Ryve (2015) give more nuanced descriptions of what the teacher educators in Sweden promoted in their teaching concerning mathematics teaching. The primary focus within the Nordic countries (Hemmi & Ryve, 2015; Solomon et al., 2015) is the use of multiple representations to develop understanding and the ability to use informal strategies and interests. The prospective teachers are taught that mathematics education must build on the students own thinking and that the assignments need to be clearly explained.

Mathematics teachers require different methods for teaching so that they can vary their teaching methods in correspondence with the students' various experiences. However, no explicit general models for teaching have yet been presented at teacher education programmes, although listening to the students and being spontaneous is a common view of teaching mathematics that is promoted. The characteristics of mathematics related to everyday mathematics, problem solving and the use of algorithms is also promoted as central aspects of the teaching.

The teacher education setting of the study

In Sweden, prospective teachers at the primary school level are typically educated to become generalists. They are expected to be able to teach a range of different subjects in the future, and one of these subjects is mathematics. Consequently, their level of education in each of the school subjects is modest, and their professional background is linked less to the teaching of specific subjects than to the profession as a whole. In Sweden, for instance, the course in Mathematics Education, which is aimed at prospective primary school teachers, is a 30 ECTS credits course in the four-year teacher education programme (240 ECTS credits in total). The course lasts 20 weeks and takes place, in this specific teacher education programme, during study semester four (See Appendix 1 for an overview of the educational structure).

In this study, the prospective teachers were chosen from the programme for the upper primary level, that is, for children in Grades 4–6 (aged 10–12). This specific upper primary school degree was established in 2011. The main reason for establishing a new upper primary school teacher education in 2011 was that the former teacher education had neglected the specific content regarded as important for teaching children aged 10–12 years old. The official report (Utbildningsdepartementet, 2011) suggested that prospective teachers had too little knowledge of the subjects. Therefore, the requirement regarding mathematics, for example, was strengthened in this new education from a minimum of 15 ECTS credits in the former teacher education to the minimum of 30 ECTS credits in the new teacher education. It also became possible to specialise in mathematics education through one or two 15 ECTS credits courses during the last year of their education. The central idea in this reform was that prospective teachers should regard themselves as upper primary teachers, rather than primary teachers in general, even though they are also formally qualified to teach 7–9 year-old students.

30 ECTS credits course in Mathematics and Mathematics Education

In this section, there will be a summary of the 30 ECTS credits course in the mathematics education (See Appendix 2 and 3 for an extended description). This 30 ECTS credits block is divided into two 15 ECTS credits courses – Mathematics, and Mathematics Education I and II. These two 15 ECTS credits courses are then divided into four 7.5 ECTS credits courses that the prospective teachers attended during their teacher education, all together totalling 30 ECTS credits. At the university where the study was conducted, all these courses were offered in the fourth semester.

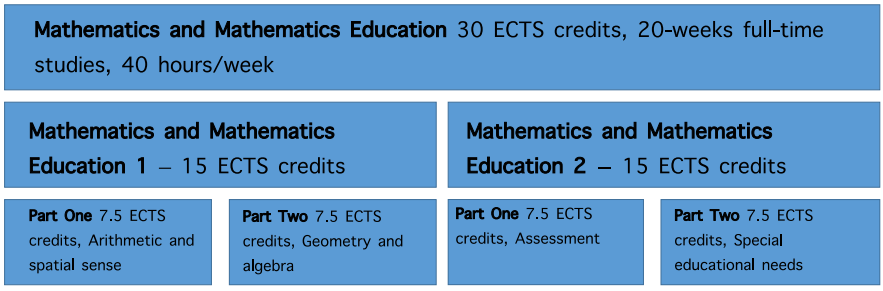

Fig 2. The 30 ECTS credits 20-week course in Mathematics Education and its deviation.

The main aims for the prospective teachers in relation to all the 30 ECTS credits courses are:

- To be able to discuss and develop an understanding of the role of the national curriculum (Lgr 11) when teaching mathematics through so-called local pedagogical planning (LPP) and to show how this can be done. An LPP is to contain certain elements when planning the teaching that one will do in the future and is regulated by the National Board of Education.
- To be able to plan, conduct, analyse and evaluate different teaching activities in primary school concerning a framework of mathematical competences.
- To be able to reflect on theories concerning learning

- To be able to view patterns between competences, mathematical content and ways of teaching mathematics to develop students' mathematics competence.
- To be able to contribute to the discussion about teaching and learning mathematics using relevant mathematics education research.

Mathematics and Mathematics Education I

The first 15 ECTS credits course is called Mathematics and Mathematics Education I for Teaching in Primary School, and is directed towards Years 4–6 of upper primary school. This 15 ECTS credits course is divided into two subcourses.

The contents of the first subcourse concern prospective teachers' knowledge of arithmetic, with a specific focus on number sense and the use of numbers and mathematical notions and how these may be taught in school. The contents of the second subcourse concern prospective teachers' knowledge of geometry, algebra, statistics, probability, relations and change. This particular content is related to educational perspectives in seminars relevant for the specific age group.

The mathematical content is discussed concerning the competences that are within the national curriculum, Lgr 11. These competences are related to the mathematical content to create a holistic view through the focus on different ways of working and strategies to support the development of students. Factors that contribute to positive learning environments are highlighted, and finally, the historical development of the content is presented.

In the academic year when the mathematics education course was followed, the first subcourse was taught by three teacher educators, and the teaching was organised as lectures, seminars, and study groups four to five days a week. Each session lasted 2–4 hours. Four teacher educators taught the second subcourse, and the teaching was organised as lectures, seminars, and study groups three to four days a week. These sessions were also 2–4 hours long. Each lecture had a specific seminar related to it.

Learning outcomes: Mathematics and Mathematics Education, I

After the first subcourse, each prospective teacher should be able to show knowledge about, and accurately be able to use, the kind of mathematics that is within the curriculum, Lgr 11, Grades 1–9, with a focus on arithmetic, number

and spacial sense, and the use of numbers and notions related to mathematics. Furthermore, the prospective teacher is meant to be able to use this knowledge concerning the specific age group one intends to teach. The prospective teachers should be able to describe how young children develop their number and spacial sense and how they can contribute to this development. They also need to be able to explain how their teaching contributes to further progress in lower secondary. Moreover, each prospective teacher should know the factors that contribute to students' positive experience of and the possibility to learn mathematics, be able to use different representational forms and understand different ways of working in the mathematics classroom, and finally, be able to contribute to the discussion about the characteristics of mathematics and how its historical foundation is developed concerning the specific mathematics of the course.

After the second subcourse, each prospective teacher should be able to show knowledge about and accurately be able to use the kind of mathematics that is within the curriculum, Lgr 11, with a focus on geometry, algebra, statistics, probability, relations, and change. Furthermore, the prospective teacher should be able to use this knowledge concerning the specific age group one intends to teach. The prospective teachers should be able to describe how young children develop knowledge in the mathematics taught in this subcourse and how they can contribute to this development. They also need to be able to explain how their teaching contributes to further progress in lower secondary. Moreover, each prospective teacher should be able to use different representational forms, know different ways of working in the mathematics classroom, and finally, be able to contribute to the discussion about the characteristics of mathematics and how its historical foundation is developed in relation to the specific mathematics of the course. The original course document in Swedish can be viewed in Appendices 2 and 3.

Mathematics and Mathematics Education II

The second 15 ECTS credits course is called Mathematics and Mathematics Education II for teaching in primary school, and it is directed towards teaching Grades 4–6 in upper primary school. This 15 ECTS credits course is also divided into two subcourses.

The content of the third subcourse concerns a deeper understanding of the national mathematical curriculum, the goals, and the grading system. The knowledge gained in the first two subcourses in Mathematics and Mathematics

Education I is now used to solve problems and to develop skills in constructing, for example, problem-solving tasks. The experience gained is also used in assignments were the students' solutions on mathematical tasks are analysed. The prospective teachers are also asked to analyse mathematics textbooks towards different aims in the curriculum. The content of the fourth, and last, subcourse concerns the prospective teachers' ability to adjust the mathematical content and way of working concerning individual students.

Four teacher educators taught the third subcourse, and the teaching was organised as lectures, seminars, and study groups approximately two to three days a week. Each session was 2 to 4 hours long. Two teacher educators taught the last subcourse, and the teaching was organised as lectures, seminars, and study groups approximately two to four days a week. Each session lasted between 2 to 4 hours. Each lecture had a specific seminar related to it.

Learning outcomes Mathematics and Mathematics Education II

After the third subcourse, each prospective teacher should be able to analyse mathematical tasks in relation to its aim, mathematical content, prior knowledge, different strategies that can be used, and critical aspects concerning students' learning. They should also be able to understand the objectives of the curriculum and the grading system in mathematics regarding the consequences of teaching and assessment, be prepared to analyse mathematical textbooks and students' solutions, and be able to construct mathematics tasks and tests in relation to the specific aims of the curriculum. And finally, the prospective teacher should be able to assess students' mathematical knowledge in relation to their individual development.

After the fourth subcourse, each prospective teacher should be able to discuss how different students' competences in tems of notions, mathematical representations, problem-solving, communication, and mathematical reasoning can be understood in relation to different mathematical content. They should also be able to show an understanding of and be able to show in practice how mathematics competencies can be developed through the use of multiple representations and variations in teaching. Finally, each prospective teacher should be able to show a deeper understanding of the teaching environment and different ways of promoting mathematical content, including ICT, to support the learning of mathematics.

Becoming a teacher during teacher education

At the beginning of this chapter, a broad overview of the content in my study is presented, both concerning prospective teachers' participation in teacher education and regarding the field of research about prospective teachers attending teacher education.

In the section following the overview, I provide information about the research perspectives of knowledge and beliefs. Even though knowledge and beliefs are not the primary focus of this study, both perspectives provide an important background and positioning.

Thereafter, I engage in a dichotomic presentation of two metaphors to guide this thesis into the research field of identity development. These metaphors are *Learning as Acquisition* and *Learning as Participation*.

The following section concerns identity development – first relating to the notion in general and then more specifically to present research examples about prospective teachers' shift in identity during and after teacher education. It also includes a brief presentation of how identity as a notion is used in this study.

Throughout this chapter, research gaps are identified. A gap can be regarded as an area that was missing in the previous research that was detected through the process of going through the literature. Gaps are interesting, as they highlight areas that may need more attention. If the missing areas in the literature review limit the ability to answer the research questions, the gap is essential for the study. These research gaps will be summarised in the last part of this chapter, which presents the basis of this study.

Broad overview

In this thesis, to enter a teacher education programme and become a teacher is regarded as a learning process that includes the process of developing a teacher identity. This process will be researched during a teacher education programme and not, as usually done, during the transition between university level and the time when the prospective teacher starts to work as a teacher. To follow the process of developing a teacher identity at teacher education means to follow how the two prospective teachers in this study negotiate and renegotiate their prior mathematics and pedagogical experience during, for example, the mathematics courses. It also studies how the experiences play out when the prospective teachers begin to teach mathematics, for example, during internships.

There is an underlying assumption in the research field of mathematics education that teachers matter in relation to students' learning. This is why knowledgeable, interested and engaged teachers are regarded as important (Sowder, 2007). Therefore, research related to teacher education and prospective teachers is required in order to understand how teacher education can stimulate the knowledge, interest and engagement of prospective teachers (Philipp, 2007). To become a mathematics teacher at primary level concerns a shift from viewing oneself as a learner of mathematics in school to a perspective of oneself as a mathematics teacher who teaches others to learn mathematics. Being enrolled in a teacher education programme is meant to change the relation one has to mathematics, teaching and learning (Rowland, Turner & Thwaites, 2014).

Research about prospective teachers attending mathematics teacher education may concern the development of knowledge used when teaching, knowledge needed for teaching, beliefs about teaching and professional identities related to the teaching profession (Palmér, 2010). These different research directions are somewhat different and therefore the kind of understanding that is produced within these research traditions varies. However, they are all focused on shifts or changes related to the teaching and learning of mathematics as prospective teachers or teachers. The researchers of this field take different theoretical directions when researching prospective teachers who undertake teacher education, but they are all interested in these shifts or changes (Adler, Ball, Krainer, Lin & Novotna, 2005; Philipp, 2007; Sowder, 2007).

When researching knowledge, the theoretical approach of Mathematical Knowledge for Teaching (Ball, Hill & Bass, 2005; Hill, Rowan & Ball, 2005) is most commonly used. Mathematical Knowledge for Teaching stresses specific knowledge that is essential for teachers to master in order to function as teachers (Sowder, 2007). Another theoretical approach that also focuses on knowledge is the Knowledge Quartet. The Knowledge Quartet stresses how knowledge plays out in specific teaching situations (Rowland, 2013; Rowland et al., 2014).

Another focus is research on prospective teachers' beliefs, that deal with teachers' mental pictures of teaching mathematics (Fives & Buehl, 2011; Pajares, 1992; Philipp, 2007).

The last theoretical focus relates to identity. Lerman (2009, 2013) divides research about identity into two parts. Socio-cultural theories draw on, for example, Vygotsky and Bakhtin, and theories concerning learning from practice, draw from, for example, Wenger's (1998) notion Communities of Practice. Other researchers, such as Holland, Skinner, Lachicotte, and Cain (1998) relate to both parts. However, various discursive approaches, for example, Critical Discourse Analysis (Fairclough, 2010), Discourse Analysis (Gee, 2014) and Discursive Psychology (Potter & Wetherell, 1987) are slowly becoming more common.

From the early 80s until today, research about prospective teachers who undertake teacher education/mathematics teacher education have mostly concerned either prospective teachers' knowledge or their beliefs (Philipp, 2007; Sowder, 2007). Less attention has been paid to the notion of identity (Skott, 2015) to better understand how the prospective teachers attend to multiple settings and how this contributes to prospective teachers' identity development (Ponte & Chapman, 2008). However, identity development as a research topic is becoming increasingly more common. There has been an extension of the unit of analysis from focusing on prospective teachers' knowledge/beliefs to including social aspects concerning how prospective teachers participate. Thus, identity is viewed as the link between individual and social perspectives.

Knowledge and beliefs

To learn to teach has traditionally been researched within a constructivist Piagetian tradition (Österholm, 2011). Österholm interprets these traditions to

be a part of the change tradition. To change knowledge or beliefs related to the teaching of mathematics requires new knowledge structures or new conceptual understanding. This thesis is not primarily about prospective teachers' knowledge or beliefs; however, a short review of these aspects provides this thesis with two things. First, it offers a background for the positioning of this study, and secondly, it provides research results that can be related to the cases of Evie and Lisa, as described in the Results chapter (see "Results: The tales of Evie and Lisa", p.101).

Knowledge

To become a primary mathematics teacher, you need to know some mathematics. First, prospective teachers need to know some mathematics to be able to follow the teaching in the teacher education. Second, prospective teachers need to be able to use the mathematics they know and develop that knowledge into teaching skills. To examine the role of teachers' mathematical knowledge concerning teaching is regarded by many as an important aspect of research in line with the political agenda, briefly mentioned in the introduction chapter (Askew, 2008; Sullivan & Wood, 2008). More specifically, that teacher education programmes need to educate teachers who are more knowledgeable in the subject mathematics. Research of mathematics teachers' knowledge has been informed in particular by Lee Shulman's work related to Pedagogical Content Knowledge to offer advice for those in teacher education. This is related to the assessing of prospective teachers' mathematical knowledge related to teaching. Many researchers regard this knowledge as a vital for developing effective mathematics teaching (Sullivan, 2008).

Shulman (1986) refers to "the missing paradigm" in research and development work on and with teachers: "What we miss are questions about the content of the lessons taught, the questions asked, and the explanations offered" (p. 8). In the 80s, he stressed the significant focus on general pedagogy and lack of discussion on the subject matter in relation to teaching. Shulman claims that teachers draw on several different domains of knowledge when planning and conducting their teaching. These are content knowledge, general pedagogical knowledge, knowledge of the curriculum, pedagogical content knowledge, knowledge of learners and their characteristics, knowledge of educational contexts and knowledge of educational aims (1987). Shulman (1987) writes that Pedagogical Content Knowledge "is of special interest because it identifies the distinctive bodies of knowledge for teaching" (p. 8).

By taking the starting point in Pedagogical Content Knowledge, Ball, Hill and Bass (2005) have developed the model of Mathematical Knowledge for Teaching. The main point in Mathematical Knowledge for Teaching, which differs from Shulman's work, is that it is not only Pedagogical Content Knowledge but also Content Knowledge that is specific to teachers. Mathematical Knowledge for Teaching is a practice-based theory that was developed by looking at actual teaching. They believed that it was important to clarify and test the concept of Pedagogical Content Knowledge empirically. The primary interest of Ball et al. (2005) and Hill et al. (2005) relates to the nature of mathematical knowledge that is needed for prospective teachers' future teaching. They suggest that there is mathematics knowledge that is unique for teachers. As Shulman, Ball et al. (2005) emphasise, teachers draws from a range of different knowledge when planning and conducting teaching.

Through their research of Pedagogical Content Knowledge, Ball and her colleagues clarified three important parts of the field: Knowledge of Content and Students, Knowledge of Content and Teaching, and Knowledge of Content and Curriculum (Ball, Thames & Phelps, 2008). Other examples of important knowledge domains are Specialised Content Knowledge, Horizon Content Knowledge, and Common Content Knowledge. Specialised Content Knowledge is defined as the "pure content knowledge unique to the work of teachers" (Ball et al., 2008, p 389). Horizon Content Knowledge reflects the awareness of content taught in the different grades of the school system, while Common Content Knowledge is related to everyday knowledge of mathematics or knowledge shared with other professionals who use mathematics.

Large parts of the research on Mathematical Knowledge for Teaching, MKT, today, concern the development of measuring systems of the mathematics that are needed for teaching (Speer, King & Howell, 2015). This is considered important information for researchers interested in how teachers' knowledge of mathematics relates to students' future results (Hill et al., 2005). The results of this development are based on questionnaires that were created to measure large numbers of prospective teachers to verify the extent of their knowledge. Becoming a teacher through mathematics education courses is considered in relation to the prospective teachers learning the knowledge that is required in order to teach (Speer et al., 2015). However, for example, Hill, Sleep, Lewis and Ball (2007) are somewhat self-critical about MKT and indicate that no instrument can respond entirely to the mathematics needed in practice, as teaching is a complex phenomenon. You cannot build upon aspects of situated

social practice in the questionnaires that establish the relation between Mathematical Knowledge for Teaching and future students' results. Nevertheless, they emphasise that the research community does need research instruments that are not interpretive to its nature in order to obtain research results that are possible to generalise.

While Mathematical Knowledge for Teaching focuses on the knowledge needed for future teaching, another framework was developed to understand the kind of knowledge that was used in practice when teaching. This framework is known as the Knowledge Quartet (Rowland, 2013; Rowland, Turner & Thwaites, 2014). Like Mathematical Knowledge for Teaching, the Knowledge Quartet also draws on Lee Shulman's work and is brought forward concerning primary pre-service mathematics teachers' content knowledge. The Knowledge Quartet can be seen as a tool for categorising prospective teachers' actions or communication (Petrou & Goulding, 2011).

Through empirical research, four dimensions of teaching were extracted and the researchers were also able to explain how mathematics content knowledge is part of the teaching. The four dimensions are foundation, transformation, connection, and contingency. *Foundation* relates to teachers' knowledge and beliefs about mathematics teaching and learning. *Transformation* relates to the transformation of foundation into forms of teaching. *Connection* refers to the decisions made when relating the mathematical content to planning and teaching in more extended sequences. And *contingency* refers to the immediate interaction that was not expected in the preparation of the actual teaching (Rowland, 2008, 2013).

A focus on knowledge has contributed to explaining the nature of knowledge as well as giving insights about that the knowledge needed when teaching is complex and draws from many different sources.

Beliefs

During the 1980s several researchers brought forward that observing prospective teachers and teachers behaviour in practice was not enough to understand educational change (Pajares, 1992). These observations needed to be supplemented with teachers' conceptions about teaching and learning. The main argument was that

> there is strong reason to believe that in mathematics, teachers' conceptions (their beliefs, views, and performance) about subject

> matters and its teaching play an important role in affecting their effectiveness as primary mediators between the subject and the learner. (Thompson, 1984, p. 105)

Eight years later, Pajares (1992) concluded that teachers' individual beliefs are the best way to research decision making in practice. The intention of beliefs research was to learn about teachers' conceptions "and how these relate to instructional practice" (Thompson, 1984, p. 125), with the aim of developing effective teaching (Pajares, 1992). Since then, the interplay between beliefs and the way we act upon our beliefs has been (Thompson, 1984; Roesken, Pepin & Toerner, 2011) a central issue when researchers discuss teacher change (Speer, 2005).

During the 1980s and the 1990s, the growing interest in teachers' beliefs about teaching and learning mathematics also began to include how these beliefs influence teaching. Much qualitative research was conducted that tried to understand how teachers' beliefs related to classroom teaching. Also, during the late 1980s and early 1990s, beliefs became regarded as a principle that guided practice. This meant that there was no need to research the social practice itself. In order to study shifts, different beliefs items in questionnaires started to be used in relation to the specific beliefs of interest to the researcher. The connections between teachers' beliefs and how they affect the expected teaching were then made visible in the statistical relationship.

This phenomenon is problematised in Thompson's (1992) research overview. Her major objection relates to the emergent research field of beliefs. First, Thompson considers it problematic that so many researchers had started to view beliefs as something monolithic, or static. From the beginning, beliefs were viewed as something dynamic that changed through experience. Secondly, she wanted the field as such to stop viewing beliefs as affecting practice in a one-way direction, and instead, suggested a more dialectical view. Her objection was related to the lack of consensus regarding the understanding of how beliefs change. The question is not solely whether the change of beliefs occurs before or after changes in practice, but rather whether or not there is a more dualistic relationship (Philipp, 2007).

Also, the so-called "problem-solving reform" in the US in the (early) 80s was considered a failure, and gradually it was acknowledged that reforming the teaching of mathematics was going to be more difficult than expected. One aspects of the failure was, according to the research community, the

inappropriate beliefs that prospective teachers had when entering teacher education and then also later as practising teachers (Schoenfeld, 2007b). There was an urgent need to change prospective teachers' and practising teachers' beliefs about teaching and learning mathematics so that teachers could perform what was considered the right way to teach (Roesken, Pepin & Toerner, 2011). As highlighted by Skott (2014), teachers were regarded as the main problem and the direct cause of the failure of the implementation of new ideas into the mathematics classroom.

In light of this, beliefs about mathematics and its teaching and learning were regarded by many as the central principle that guided mathematics teachings (Fives & Buehl, 2011; Forgasz & Leder, 2008; Leder, Pehkonen & Törner, 2002; Pajares, 1992; Roesken et al., 2011). The argument was that beliefs significantly shape classroom practice, suggesting there is a causality between teachers' beliefs and students' learning. However, Roesken et al. (2011) emphasise that the hypothesis from the 1980s – that beliefs are the determinant factor of practice – was "never conclusively proven" (p. 451). Therefore, there is no consensus today that this premise was ever fulfilled (Philipp, 2007; Skott, 2015; Speer, 2005).

What are beliefs considered to be?

The notion of 'beliefs' is often taken for granted, and researchers are not specific about what they mean when using the notion. Even though the problem of defining the notion is well documented, there is still no consensus within beliefs research (Leder et al., 2002; McLeod & McLeod, 2002; Pajares, 1992, Philipp, 2007). Therefore Philipps (2007) and Törner (2002) point out that it is important that the specific researcher makes explicit the relation and content within the notions used.

The problem of the notion not being clearly defined (McLeod & McLeod, 2002; Törner, 2002) has led to the use of various notions connected to beliefs such as:

> attitudes, values, judgement, axioms, opinions, perceptions, conceptions, conceptual systems preconceptions, dispositions, implicit theories, explicit theories, personal theories, internal mental processes, action strategies, rules of practice, practical principles, perspectives, repertoire of understanding and social strategy. (Pajares, 1992, p. 309)

There is a discussion within the field concerning whether to keep the notion or else find another way to research teacher change. Törner (2002) makes an explicit critique of the use of various notions, emphasising that this weakens the concept. Op´t Eynde et al. (2002) emphasise that a coherent theory was not possible at the time but is needed in the future, while McLeod and McLeod (2002) choose another direction and state that there is no need for a coherent approach in the future. In either case, one can conclude that the problem of defining the concept is still a question within the field today (Skott, 2014). However, the diversity of the field related to the notion has been natural because researchers' primary interests have not been to develop a coherent approach. Instead, the focus has been on organising the empirics in the specific projects (Op´t Eynde et al., 2002).

However, it is possible to talk about a core understanding of the notion. Beliefs are usually regarded as something internal – an individual mental construct true for the individual (Pajares, 1992). This truth is filled with a high degree of conviction (Skott, 2014). Beliefs are then regarded as something that one holds as true (Op't Eynde et al., 2002) that is hard to change or basically unchangeable (Leder et al., 2002). Fives and Buehl (2011); Lerman (2002); Philipp (2007); Skott (2013); Skott, Larsen, and Östergaard (2011) and Speer (2005) emphasise how most researchers view beliefs as stable mental objects. Therefore, beliefs need to be profoundly challenged through interventions over an extended period (Sowder, 2007). However, the view of beliefs as stable mental objects is also challenged. According to a meta-study by Liljedahl, Oesterle, and Berneche (2012) on articles related to beliefs research, most researchers within the field emphasise that educational change can happen if the educational intervention is the right one. They conclude that "taken together, it is imperative that when talking about beliefs in mathematics education we stop using the characteristic of stability as a defining quality" (Liljedahl et al., 2012, p. 113).

In the described research, beliefs are held internally in different ways. Skott (2014) points out in his research overview that different researchers explain that beliefs can be conscious or unconscious, may be held in unrelated clusters, and may be central or peripheral in relation to their significance.

Beliefs research has been a valuable approach when trying to understand the underlying reason for teachers' actual teaching. The basic idea is to transform prospective teachers' and teachers' beliefs about mathematics teaching and learning. This transformation will then lead the prospective teacher or teacher to transform their classroom practice.

Criticism of MKT and beliefs research

Becoming a mathematics teacher in the perspectives presented above concerns the gaining of the right knowledge and the right beliefs. There is an expected correlation between prospective teachers' knowledge and beliefs and how teachers enact this knowledge and beliefs in practice. There is an a priori expectation that Mathematics Knowledge for Teaching and beliefs will guide the actual teaching that is conducted later.

Askew (2008) and Barwell (2013) criticise Mathematical Knowledge for Teaching and the Knowledge Quartet. They point out that knowledge is more situated than the literature that draws on Pedagogical Content Knowledge wants to admit (Barwell, 2013). However, Ball and her colleagues raise this issue and suggest Discourse Analysis as an alternative research approach in relation to Mathematical Knowledge for Teaching. Discourse Analysis would be an approach that takes the field of Mathematical Knowledge for Teaching in another direction (Hill et al., 2007). However, from their point of view, the demands of fine-grained discursive frameworks are too complicated and will require too much of the scientist to learn and master. The frameworks used in such research need to uncover fine-grained discursive patterns. Hill et al. (2007) point out that this would be a most interesting approach for the future but hardly realistic because it would be too time-consuming.

Beliefs research is notorious for its conceptual, methodological and theoretical problems (Skott 2013, 2015). This is evident when looking at different research overviews. Pajares writes his research overview from 1992 under the heading "Cleaning up a Messy Construct", and Fives and Buehl's research overview from 2011 is called "Spring cleaning for the 'messy' construct of teachers' beliefs: What are they? Which has been examined? What can they tell us?"

The concept of beliefs is mystified because the researcher must identify a person's unconscious beliefs (Pajares, 1992). This makes the research interpretive in its nature (Wilson & Cooney, 2002) and causes methodological issues that researchers need to resolve. A central ground of science is that research is to be thoroughly conducted. The concept needs to be explicitly clarified and methodologically carefully chosen to make the research explicit and understandable (Pajares, 1992). Philipps (2007) points out that this does not happen in many cases, which leads to research that tends to be normative. Because the notion is not operationalised, there will be problems concerning methodology (Skott, 2014).

Skott (2014) stresses two problems when using beliefs items in standardised instruments using short answers from the respondents. First, the prospective teacher or teacher that replies to the beliefs item needs to interpret the instrument in the same way as the researcher. Secondly, there is a risk that the instrument itself attributes beliefs to the person doing the item instead of eliciting the beliefs from the item. Wilson and Cooney (2002) wonder if it is possible to reveal the objectified beliefs that determine teachers' actions by the current methodological approach using beliefs items.

A belief can also be externally manifested in how a person acts. The manifested embodied actions are generally called a person's 'ground beliefs' and are sometimes considered a person's fundamental knowledge (Philipp, 2007). A central critique, however, is that the beliefs research is based on a circular argumentation: Teachers' beliefs explain any practice, and teachers' beliefs can be researched by observing practice (Skott 2013).

One can conclude that beliefs research has methodological and conceptual problems, "but on the other hand we also have missing connections between aspects of theory and empirical research (Österholm, 2011, p. 58)". Pajares (1992), Österholm (2011) and many others point out that this has led to the fact that there often is a missing link between aspects of theories concerning empirical analysis and results within beliefs research. Thus, the relation between beliefs and enactment in practice becomes "taken for granted". The idea that beliefs affect teaching is not an empirical result from the research. It can be thought of as like an axiom within the notion itself (Skott, 2013). Therefore, the transition of a person's knowledge of or orientation in mathematics into a teacher teaching mathematics is not sufficiently clear from these perspectives (Ponte & Chapman, 2008).

Experience of mathematics teaching and learning

Although this thesis concerns identity development, the aforementioned perspectives are particularly relevant to the Results chapter. In the three following sections, research about prospective teachers' prior experience of mathematics education/classrooms, the deficit story of the prospective teacher, and the experience of mathematics teaching in the teacher education are presented. More research on prospective teachers could also be presented here; however, in this section, I decided to focus on studies that can be related directly to the experiences that the prospective teachers mention themselves. Evie and Lisa, the two prospective teachers in the study, sometimes call upon

perspectives that are normally not considered in the identity development research. One example is the 'deficit story', which is questioned by many researchers but nevertheless discussed by both the prospective teachers themselves and the teacher education programme referred to in this study. It is clear that Evie and Lisa use it as a way of positioning themselves and therefore the concept becomes important even though it is not completely in line with the theoretical language of this study. In the same way, other perspectives presented in this section may stand out in relation to the main theoretical perspectives in this dissertation. Instead, they belong to the constructivist Piagetian tradition.

Prospective teachers' past school-related experience

To become a primary school teacher through teacher education is regarded by some researchers as problematic because of the relationship prospective teachers have regarding their own past school-related experience (Hodgen & Askew, 2007). Forgasz and Leder (2008); Philipp (2007); Sowder (2007) and Wilson and Cooney (2002) even conclude that teacher education has little impact on prospective teachers' beliefs, standing little chance of affecting their future teaching. Prospective teachers' own schooling has a greater impact when it comes to affecting prospective teachers than teacher education itself may have (Philipp, 2007).

If this is the case, prospective teachers' prior experience make them teach/behave in a specific way. For example, prospective primary teachers often share the idea of the caring teacher as important rather than a generalist teacher who will teach different subjects. According to Cooney (1999), this is because they themselves struggled with mathematics in school. Similarly, in a study by Gellert (2000), prospective teachers who struggle with mathematics in school wanted to create a so-called "safe space" to protect their future students from mathematics. Prospective teachers sharing this experience of mathematics as a problem wanted to give their future students a gentler experience of mathematics than they themselves had. This indicates that prospective teachers' anxiety regarding mathematics includes their previous experience, extending the arena beyond the teacher education itself. Moreover, prospective teachers' anxiety is also transmitted to students in their future mathematics teaching (Stoehr, 2015). In the studies referred to here, the subject of mathematics itself becomes subordinated for these prospective teachers, and social development becomes the primary aim of schooling instead (Cooney, 1999; Gellert, 2000; Stoehr, 2015).

Through their past school-related experience, many prospective teachers view mathematics as a set of fixed rules that one needs to learn and master. From this perspective, to be able to learn and master mathematics, you need to be a "math person". Either you have the abilities of a "math person" or you do not. Either you understand the universal laws of mathematics or you do not (Felton-Koestler, 2015). In this regard, prospective teachers usually have a belief of teaching mathematics as not complicated. In Cooney's (1999) article about primary prospective teachers' conceptualisation of knowing this phenomenon is described as "teaching as telling". As a mathematics teacher in the future, you tell students what to do and how things are, and then they will learn.

Research about prospective teachers' past school-related experience and how this impacts how they become teachers in different ways indicates that almost all prospective teachers' past school-related experience needs to be regarded as important (Sowder, 2007). Prospective teachers have different needs. They have "problems" from the past to solve and therefore often educational agendas of their own making that need to be addressed during their teacher education. However, Sowder (2007) questions whether teacher education in general, and mathematics education courses in particular, are set up to meet the diversity of prospective teachers – prospective teachers are not a unified cohort of people (Oliveira & Hannula, 2008).

Most research concerning past school mathematical experience and how future teachers relate to this experience concerns prospective teachers' knowledge or beliefs. There are not many studies interested in prospective primary teachers with good experience in mathematics teaching and therefore few studies focus on those who regard themselves as knowledgeable and interested in mathematics. On the contrary, there is much research about inappropriate beliefs, lack of mathematical knowledge, misconceptions in mathematical understanding or mathematical anxiety, et cetera (Askew, 2008; Philipps, 2007; Sowder, 2007). The mathematically knowledgeable, interested and engaged primary prospective teachers in teacher education indicate a gap in this kind of research.

The deficit story of prospective teachers and possible consequences

Well aware of the different stories told about prospective teachers, this section will deal with research related to the deficit story of prospective teachers. It will also be indicated how this may have consequences for how the teaching within teacher education is arranged. However, the deficit story is also a political story.

In Sweden, the argumentation of the political debate (LR, 2016) focuses on the not-knowledgeable prospective teacher. In official reports, due to the perceived lack of knowledge, it is concluded that prospective teachers need to learn more mathematics during their teacher education (Utbildningsdepartementet, 2010).

What the political agenda and also some of the studies about knowledge and beliefs have established is a deficit model of prospective teachers (Askew, 2008; Cooney, 1999). According to Askew (2008), this has primarily turned attention to two things. First, the attention has focused on what prospective teachers do not know, instead of what they know. Second, there has been a focus on the arguments of the political debate rather than the research itself, and this can be solved by more subject knowledge – more knowledge is what it takes.

However, as Askew (2008) and Oliveira and Hannula (2008) explain, this deficit story needs to be used gently by the research community. The reason is that the story itself creates a specific way of talking about prospective primary teachers as problematic. This deficit story can also be distinguished in the current Swedish teacher education and it has influenced the way teacher education is set up in relation to the participation of prospective teachers on courses in mathematics education. The primary focus has been on what prospective teachers do not know as a sort of big crisis that needs to be fixed (Hemmi & Ryve, 2015; Player-Koro, 2011). In line with the truths created in the political debate, more knowledge simply is what it takes to fix the problem of the prospective teachers.

Teacher educators at primary level are concerned about prospective teachers' low mathematical priorities and skills as well as their anxiety regarding mathematics. Teacher educators want to help prospective teachers to relieve their mathematics anxiety and show another side of mathematics. This concern affects the way prospective teachers are positioned to participate in teacher education. As a result, through commonly shared understandings about prospective teachers, teacher education positions teachers as not capable of doing mathematics (Hannula, 2002). It is clear that the anxiety of prospective teachers and the shared assumption of prospective teachers as not knowledgeable affects how teacher educators allow prospective teachers to participate within the mathematics education course (Stoehr, 2015). Hannula (2002) describes this phenomenon as the therapeutic side of teacher education, and it is considered to be a part of the Swedish teacher education (Hemmi and Ryve, 2015; Player-Koro, 2011).

Sowder (2007) concludes that most teacher education programmes have a "one-size-fits-all" mentality. Sowder (2007) indicates the possibility of teaching at teacher education, in a caring way, is adjusted to the view of the prospective general teacher as a problem to fix.

Based on the prevalent deficit story, an important question that comes to mind is how prospective teachers who are interested in mathematics experience their participation in a setting where the deficit story is reinforced in both society and in teacher education. The lack of research in this direction is a clear example of a narrow view of the prospective teacher. This is highlighted by Askew (2008), who calls to attention the commonly shared understanding of a primary prospective teacher and teacher as problematic. Askew describes how we as a research community are so eager to focus on the lack of knowledge and misconceptions that we have missed that there are prospective teachers who are indeed keen on both learning and teaching mathematics. This then is a highlighted gap in the research literature. The research community needs to understand different prospective teachers' ways of participating during teacher education instead of solely focusing on the one-way picture (Oliveira & Hannula, 2008).

Experience of mathematics teaching at teacher education

Player-Koro (2011) critically examines how mathematics discourses emerge within one particular Swedish teacher education programme. She concludes that prospective teachers experience no significant difference between teacher education and the school they attended in the past. From the prospective teachers' point of view, they claim that there is too much "mathematics" and too little "mathematics education". The tradition is the same when it comes to the learning of mathematics at teacher education as in school, and therefore, teacher education reproduces the school mathematics experience despite that teacher educators promote a different view.

In Player-Koro's (2011) study, prospective teachers who struggled with mathematics at school continue to struggle during teacher education, while the prospective teachers who enjoyed mathematics in school continue to enjoy it at university. She questions if prospective teachers enjoy mathematics based on their interest in a future profession as a mathematics teacher or if they still have "performative priorities" (p. 325), echoing the traditional mathematics teaching they are used to from previous education, which is simply enjoying being good at mathematics. Here, performative priorities relate to the achievement of the

individual in perceived competitive environments. Mathematics exams at teacher education became the critical element in the "performative culture" (Beach & Player-Koro, 2012, p. 121). Player-Koro concludes that performative culture may constrain the development of other critical professional skills.

Beach and Player-Koro (2012) question teacher education, and in particular, how the mathematics content is brought forward. Ebby (2000) suggests that teacher education needs to foreground other things than prospective teachers' previous knowledge related to mathematics. Instead, the courses related to mathematics education should focus on "habits of mind" so that prospective teachers develop skills concerning contrasting and learning from different classrooms, which will challenge their previous experience of mathematics. This will give the prospective teachers perspectives on mathematics education other than that which they previously held. This is important from a social constructionist point of view, as put forward by Felton-Koestler (2015), who asserts that teacher educators need to ask themselves what kind of experience teacher education mirrors when it comes to the role of mathematics, more specifically, whose perspective is represented, and how does this relate to the learning and teaching of mathematics at the primary level?

Learning as acquisition or learning as participation

Different ways of researching how prospective teachers become teachers identify themselves to others. The most commonly used discursive counterpart within mathematics education is that which distinguishes the metaphor of learning as acquisition from the metaphor of learning as participation (Sfard, 2008, 2009; Stetsenko, 2008). The perspectives of knowledge and beliefs are usually connected to the first metaphor, while identity development is usually related to the learning as participation metaphor. By discussing this discursive counterpart, this section sets out to build a bridge into the specific perspective used in this study – that of identity development.

Beliefs research, Mathematical Knowledge for Teaching, and the Knowledge Quartet are, within the research field of mathematics education, sometimes connected to/related to the metaphor of "learning as acquisition". They are associated with a constructivist underpinning (Skott, 2014; Österholm, 2011). In this perspective, the key definition of learning is obtaining knowledge or beliefs as an individual process "in the head" of the learner (Stetsenko, 2008). Keywords used within the approaches associated to learning as acquisition may

be mental schema, knowledge, concepts, content, acquisition, and transmission, et cetera. In this sense, learning as acquisition places emphasis on the individual mind and the kind of knowledge or beliefs that enter the mind (Sfard, 2008; Stetsenko, 2008). Knowledge and beliefs are both expected to implicitly generate teaching of a specific kind, and they are indicators of how prospective teachers may teach in the future.

However, pitting different perspectives against each other can be problematic because this focuses on contrasts and neglects similarities. In that sense, dichotomising has its limitations, and therefore, it is important to stress that the Knowledge Quartet, for example, can be interpreted as belonging to the learning as a participation metaphor and not solely to the learning as the acquisition metaphor that it is normally connected to. For example, contingency has a situative aspect. However, to delve deeper into this is beyond the intention of this study.

The overall aim of this study differs from those with a focus on acquiring of new knowledge structures or beliefs. Here, the focus is on how experience from teacher education and other relevant social practices matter to prospective generalist teachers' imaginings of themselves. This relates more to how they participate in their everyday life as being prospective teachers than how they acquire knowledge structures or beliefs. Thus, the interest of the study refers to human lived experience and how past experiences contribute to prospective teachers' participation in teacher education. This is more in line with the learning as participation metaphor and the notion of identity.

Learning as acquisition is defined as obtaining knowledge or beliefs as an individual process *in the head*. In contrast to this, the definition of learning as participation is defined as shifted participation or becoming a member of a community/social practice. Keywords used within the "learning as participation" metaphor may be apprenticeship, situatedness, cultural embeddedness, discourse, and cooperation. In the learning as participation metaphor, the individual and the social practice affect and inform each other (Stetsenko, 2008). Learning as participation is situated within what is called the 'social turn' in mathematics education (Lerman, 2000). The social turn relates to learning to teach mathematics as understood as increasing participation that contributes to the identity development of the prospective teacher.

The theoretical focus that aligns with learning as participation relates to what is known as a situative perspective. Situated learning takes very complicated

social, cultural and historical systems into account as well as how our own and others' prior experiences relate to our present participation in social practices (Palmér, 2016). The relationship one has with various social, cultural and historical systems enables one to act and participate in the immediate social interaction in particular ways.

Each of us experiences situations in our own way (Wenger, 1998). In different situations, learning is an emerging process – an aspect of human lived experience (Lave, 2000; Prus, 1996). Learning is relational and negotiated among those who participate, both historically and in the present. The perspective of learning as participation illustrates identity development as a learning process (Lerman, 2006; Sfard, 2008). Learning then can be understood as "becoming a different person with respect to the possibilities enabled by these systems of relations" (Lave & Wenger, 1991, p. 53).

In relation to this, Adler et al. (2005), Grevholm (2010) and Hemmi and Ryve (2015), for example, call for understandings about how prospective teachers develop and how identity emerges during teacher education. This leads to an understanding of how mathematics and teaching are moulded in teacher education. By adopting a perspective on identity rather than on knowledge or beliefs, this study sets out to understand how prospective teachers develop and situate themselves in different situations and social practices. My aspiration is to interpret how prospective teachers dynamically develop a teacher identity during parts of teacher education.

Identity development

In the following section, I provide this thesis with three things. First, a general overview of the notion of identity and different directions on identity development. This first section will end by showing how identity is understood in relation to the study. Second, identity development research relating to the internship experience will be described, followed by the final section, which details the specific narrative/ethnographic cases of this study.

Characteristics of identity development research

In the 1980s, many researchers were already questioning a focus that was dependent on the content in people's minds without taking context into account (Philipp, 2007). Potter and Wetherell (1987), for example, promoted Discursive Psychology as an alternative when researching attitudes and values, and in line

with this, Prus (1996) promoted ethnography and symbolic interactionism as alternative ways of investigating human behaviour as human lived experience. Others, like Lave and Wenger (1991), shifted focus from the individuals' minds to groups of individuals that participate with each other and share common goals and agendas. Wenger (1998) terms a group of individuals that have a shared enterprise over time as a 'community of practice'.

During the last ten years, identity has become increasingly more popular as a focus in mathematics education research (Morgan, 2012; Skott, 2015) and is mostly regarded as an ongoing process described in participatory terms. However, Lerman (2013) and Morgan (2012) imply that the notion is becoming "over-used" and simplified in a problematic way. When a theoretical concept becomes well known, people tend to stop elaborating on it. It is taken for granted.

In her research overview, Darragh (2016) identifies two main paradigms related to identity development. The first is a psychological frame where identity is viewed from an acquisitionist point of view. In this perspective, identity is regarded as something internal that one has inside. The other perspective is a sociological frame where identity can be regarded as an action in a specific situation. Darragh relates this sociological frame to George Herbert Mead and Symbolic Interactionism.

Darragh (2016) distinguishes three broad themes of identity research within this sociological frame. The first is described as performative identities. Performativity relates to how language influences different forms of immediate social interaction. In this way, performativity influences the identity of the individual when participating in social practices. It marks out the positions in which one can assume. Once committed to a position, one can maintain and continually improve the position or abandon it for another position. Positions are not static and should rather be understood as interpretations made by the individual (Jeffery & Troman, 2011). For example, Mosvold and Bjuland (2016), Skog (2014), and Skog and Andersson (2015) build on positioning theory in relation to prospective teachers' identities. Positioning theory is interested in the process of becoming, foremost in terms of how the participants identify positions within activities related to, for example, teacher education.

The second category is what Darragh (2016) terms 'narrative identity', and this relates to a person's evolving life story. She includes two perspectives in this

second categorisation: Discursive Psychology relating to Potter and Wetherell (1987) and Telling Identity, which relates to Sfard and Prusak (2005).

The first perspective focuses on how reconstructed prior experience, present experience, and future imagined experience are integrated into narratives to provide life with a purpose (McAdams & McLean, 2013). Kaasila (2007b), Kaasila and Lauriala (2010), and Lutovac and Kaasila (2014) draw on discursive psychology to mark what is known as 'interpretive repertoires' as identity indicators. *Interpretive repertoires* can be seen as systems of language that are integrated and related to a social phenomenon that is used in immediate social interaction.

In the second perspective, Sfard and Prusak (2005) introduce the notion of Telling Identities. They equate "identity with stories about persons" (p. 14). *Telling identity* is explained as a set of reifying, significant, endorsable stories about a person, where one implies inclusion or exclusion in social practices. The main aim for Sfard and Prusak is to provide the notion of identity with an operational definition in order to allow discursive constructions to be investigated. However, making it operational in this way creates problems. The main problem with Telling identities is that it relies solely on spoken language, which means that it excludes other expressions in a discourse, such as gesture and body language.

The last category is termed 'participatory identity' (Darragh, 2016), it and relates to social practice theory, especially the notions of figured worlds (Holland et al., 1998) and Community of Practice (Wenger, 1998). Skott (2018) explains that social practice theory views individual identities as contextually embedded and dependent, and therefore, multiple, fluctuating, and always in-the-making. Figured worlds are collective as-if worlds that shape and are shaped by situated participation. For example, Horn, Nolen, Ward, and Campbell (2008), Jong (2016) and Skott (2015) use figured worlds to inform their studies to align with or relate to identity. Skott "seeks to understand how a teacher's interpretations of and contributions to immediate social interaction relate dynamically to her prior engagement in a range of other social practices" (Skott, 2013, p. 549) and figured worlds (Skott, 2015). Jong set out to understand how prospective teachers "figure their world of teaching based on contextual factors" (Jong, 2016, p. 297) and Horn and colleagues aimed "to illustrate the way that identity shapes and are shaped by their learning" (Horn et al., 2008, p. 62).

Wenger (1998) brings forward the notion of identity as central in relation to the community of practice. He suggests that "issues of education should be addressed first and foremost in terms of identity and modes of belonging, and only secondarily in terms of skills and information" (p. 263). Communities of practice are groups of people who sharing concerns about entities, and within these groups, individuals learn to participate in different ways (Wenger 1998). Within and in between communities of practice, one negotiates specific ways of being. Identity is described as "a layering of events of participation and reification" (p. 151). In all these perspectives, identity is related to participation in different social practices (Bjuland et al., 2012; Horn et al., 2008), where positions, narratives/stories/tales, or participation are all conceptualised in terms of timescales that extend over a long period of time.

Research about identity development is usually not situated within one of these categories. There is often an intersection between them. The last category and some research related to discourse analysis, for example, Kaasila (2007a), stresses language and social practices as stratified in time and space. They share the same theoretical inspiration, in this case, Bakhtin's notion of 'heteroglossia'. Positioning theory focuses on power relations within social practices often using certain Foucauldian perspectives. Another example can be found in Palmér (2010, 2013, 2016), who combines both the conceptual framework developed by Skott and Wenger's Community of Practice. Bjuland et al. (2012) build their theoretical frame around Wenger's Communities of Practice, Sfard and Prusak's (2005) Telling Identities and Holland et al.'s (1998) Acts as Indexical to generate indicators of identity. Identity as a notion is evidently complex, and each study needs to define and justify it (Morgan, 2010; Mosvold & Bjuland, 2016). Moreover, the concept of identity is generally divided into research concerning the individual or the community (Bjuland et al., 2012).

Defining identity in this study

Following the Meadian tradition explained in Darragh (2016), I am interested not only in the act of identifying as a mathematics teacher during teacher training but also as a teacher in the future. Of particular interest is how this "identifying" evolves during an extensive period. Later in this thesis, this is foregrounded through the conceptual framework of Patterns of Participation, a participatory (Darragh, 2016) and individual (Bjuland et al., 2012) identity that draws on Symbolic Interactionism and Social Practice theory. Identities are

viewed as renegotiated between past and present social practices and figured worlds.

In this study, social practices are regarded as a collective way of being – a specific social interaction (Fairclough, 2010) with a common endeavour (Wenger, 1998). The notion of figured worlds is covered extensively in the theory chapter.

This study defines identity as "the imaginings of self in worlds of action" (Holland et al., 1998, p. 5). However, this definition has its limitations in relation to imagined future teachings. When engaging in future teachings, I define identity as "the imaginings of self in imagined worlds of action".

Through Holland et al.'s (1998) so-called figured worlds, people re-engage with others implying who they are, but even more importantly, they re-engage with themselves and then try to act as though they are who they say they are. Imaginings of selves are expressed in immediate social interaction – they are dynamic and situated and change in time (Lemke, 2000) and space (Gee, 2001). In relation to Holland et al. (1998), identities are improvised during "the flow of activities" (p. 4) where one uses the cultural resources available. This interest is cross-cultural and cross-situational. The next chapter concerning theory aims to further conceptualise this.

Illustrating becoming as shifts in identity

This section deals with two themes. First, it elaborates on the role of the internship for a prospective teacher, and secondly, it concerns prospective teacher's identity development during an extended period, covering more aspects of teacher education than solely the internship.

The role of the internship experience

Internships are regarded by many researchers as a powerful source of identity development (Bjuland et al., 2012). However, the internship has both potentials and drawbacks. Experience from an internship can be both positive as well as negative in relation to prospective teachers' identity development (Ebby, 2000; Jong, 2016). This section explains what we know about the role of the internship for the prospective teacher's identity development.

During teacher education, prospective teachers attend several internship periods. These internship periods form one part of the teacher education. During

these periods, prospective teachers meet educated teachers who teach mathematics. At the internship, they meet role models, and importantly, negotiate their past school-related experience with the new experience of teaching mathematics.

A prospective teacher's significant shift in identity usually takes place during these internship periods (Bjuland et al., 2012) rather than during teacher education courses in mathematics education (Jong, 2016). The internship is described as the most common period when significant shifts in prospective teachers' identities can be traced. However, the internship is also important in another way, as it affects the participation of prospective teachers in the courses that concern mathematics education (Hodges & Hodge, 2015; Mosvold & Bjuland, 2016). Prospective teachers find educational models, good or bad, within the internship experience that they later apply on other settings, for example, the mathematics education courses (Aydar, 2015; Horn et al., 2008; Walshaw, 2004).

Through reflective narratives, Mosvold and Bjuland (2016) explore prospective teachers in relation to the internship. In their study, prospective teachers re-tell narratives from their past school-related experiences, the internship itself and how the internship motivated them concerning their future profession. The prospective teachers in the study think of themselves foremost as students who attend school. For example, the prospective teacher, Siw, identifies herself as somewhat successful and as someone who enjoyed school as a former student. Her positive experience can be recognised in her present experience in the internship. After her internship, she develops another position rather than the position of being a past student in school. She now refers to herself as a prospective teacher in training. This is a clear example of the educational shift mentioned earlier.

As Mosvold and Bjuland (2016) argue, internships seem to have an important role, even the most important role, when comparing the different parts of the teacher education programme. It is interesting to note that, in Solomon et al. (2015), internship supervisors regard teacher education courses as too general and as not providing prospective teachers with the tools to handle teaching. This suggests the attitude that teacher education fails to prepare prospective teachers for the future – an attitude that falls in line with the political agenda pointed out earlier. According to many internship supervisors, prospective teachers are ill-prepared for the profession and lack the knowledge they are supposed to have when it comes to teaching and learning mathematics. In their study conducted

in Norway, Solomon et al. (2015) indicate that, in one way or another, internship supervisors, from their point of view, frame the teaching of the prospective teachers and provide them with educational tools that the teacher education fails to offer. This view can also be connected to the deficit story discussed earlier.

The tension between teacher education and internship

Some research concerning teacher education specifically highlights the tension between teacher education and internship, which often explained as the theory/practice dilemma, for example, by Solomon et al. (2015). One aspect that stands out in their research is that the prospective teachers do not use teacher education as a means for understanding the theory and practice relation (Scott, 2005). Rather, they treat the internship and university-based teacher education as opposites, and it is clear that the ideas promoted in teacher education courses are contrasted with the teaching promoted during the internship by both the internship supervisors and the prospective teachers themselves (Aydar, 2015). Oliveira and Hannula (2008) and Scott (2005) emphasise that prospective teachers thus rather rely on educated teachers at the internship or from other settings, or on family and friends instead of teacher educators, to conclude their vision of future teaching. Prospective teachers seem less sceptical when it comes to accepting advice from others than from the teacher educators (Oliveira & Hannula, 2008).

Lia Lin and Ponte (2008) stress that teacher education in this sense needs to rethink their teaching and step forward as the central discussion partner concerning mathematics education. This is described as especially important in relation to the first internship experience where prospective teachers, in general, have to renegotiate many of their assumptions about being a teacher (Solomon et al., 2015). Moreover, from Jaworski and Gellert's (2003) point of view, prospective teachers also need individual support from teacher education to reflect on their future teaching. When the teaching models encountered at internship do not cohere with the models of teacher education, they need to be questioned or at least highlighted by the teacher education community (Horn et al., 2008). Prospective teachers attend two different competitive social practices (Solomon et al., 2015) where teacher education is given the lowest priority and legitimacy (Scott, 2005).

An interesting paradox in this section relates to the fact that teacher education wants to solve the theory/practice dilemma through the internship, while research illustrates how teachers working in internships use teacher education

as a discursive counterpart in which they tend to promote their own teaching as the real thing. The result is that teacher education lose legitimacy. To summarise, research emphasises the role of internship not only in relation to identity development but also in relation to how internships symbolise the transition between teacher education and the prospective teacher's future practice. This study aims to contribute to understandings of how this transition evolves during an extended period, as this is a gap I have identified in the research literature.

Illustrating becoming in longitudinal studies

In the former section, the role of the internship was highlighted in relation to shifts in prospective teachers' identity formation. This section concerns prospective teachers' and teachers' identity development during an extended period. In this longitudinal process, Hodges and Hodge (2015) recognise prospective teachers who bring together different perspectives on teaching and learning mathematics, which may often conflict, while creating their idea of how to teach mathematics. However, how this is done varies greatly with each prospective teacher.

There is limited research about prospective primary teachers' identity development during teacher education. The studies that can be found relate to secondary school and above or experienced teachers attending in-service courses. Therefore, the examples that are given in this section relate to both practising teachers and prospective teachers.

One way of pointing out identity development is to develop or use identity indicators. Bjuland et al. (2012) followed the experienced primary teacher, Agnes, through what they call 'reflective narratives'. Through the case of Agnes, they developed identity indicators that they consider to be evidence that Agnes' identity develops. In their study, Bjuland et al. (2012) promote that professional identity development can be understood and illustrated through these indicators, which can be traced in the process of becoming a teacher. First, they mention how teachers can position themselves in relation to future students. Secondly, they discuss how teachers relate their participation to different educational models. Thirdly, they point out how educational models are expanding and becoming integrated into teaching models. The final identity indicator shows how teachers develop a critical positioning to the pedagogy taught and used at teacher education.

Jong (2016) illustrates, through the case of Sonia, a novice teacher, that teacher education has an impact on prospective teachers' development in different ways. However, attention must be brought to the characteristics of the prospective teachers' identities that draw on ideas from one's past teaching experience and one's past cultural, socioeconomic and linguistic background. Identity is influenced by contextual factors that are used in the identity development of the prospective teachers.

In her study, Jong highlights that becoming a teacher actually starts the day a person starts school for the first time as a child. As a student, you experience teaching models that are used when entering teacher education. These models influence the idea of teaching that prospective teachers have, but the already existing models are strong. The teacher educators underestimate the previous experience of the prospective teachers and do not take any position to challenge their experience. Teacher education needs to question and discuss the figured worlds that prospective teachers draw on in their communication.

The main result in Jong's study is that Sonia's figured worlds about teaching and learning mathematics are critical because they inform every social practice that she attends, albeit in different ways. These figured worlds influence the mathematical teaching model that Sonia as a prospective teacher brings to the fore, the commitment she has to show at teacher education, and the way she promotes teaching. Jong points out something important for this study, namely, that we need to take into consideration aspects other than only teacher education as significant contributors to the identity development of prospective teachers. She specifically mentions figured worlds as legitimate cultural worlds that need to be recognised by the teacher educators.

Other longitudinal studies are, for instance, the case descriptions of Elin (Andersson, 2011), Leila (Kassila, 2007b), Ursula (Hodgen & Askew, 2007), and Sirpa (Kaasila, 2007a). Elin is an upper secondary prospective teacher, who is followed by Andersson (2011). Andersson (2011) uses Sfard and Prusak's Telling Identities to understand Elin's transformation of her teaching. The data in her study comes from interviews and conversations with Elin over the timespan of one year, a period when Elin becomes aware of herself in regard to her teaching. Andersson's narrative identities reveal why Elin does not get to become the kind of teacher she has wished to be. Kassila (2007b) lets us follow the story of Leila and how she turns her bad memories of mathematics teaching and learning into a positive experience during teacher education. As a consequence of the teaching in the teacher education, Leila's identity as a

teacher in mathematics is strengthened. Another example is the teacher, Ursula (Hodgen & Askew, 2007), who changes how she feels about the mathematics and mathematics education setting and how she develops strong feelings about the teaching promoted in the teacher education. In the beginning, Ursula actively resisted the mathematics education setting but eventually aligns with its intentions. Kaasila (2007a) presents the prospective teacher, Sirpa, and how she constructs her identity during teacher education by looking at interpretive repertoires used in immediate social interaction. Throughout every interview, Kaasila concludes that Sirpa, little by little, aligns with the intention of the teacher education during her education process, and that during the process, she is regarded academically successful.

This means that only one article in my search for literature mentions the specific kind of prospective teacher who is foregrounded in this study, namely, the one who is mathematically knowledgeable. However, the case of Sirpa takes place exclusively in the teacher education. Kaasila does not consider the "outside" in his research. The only researcher who considers the "outside" is Jong (2016), and this through the notion of figured worlds. Her research question relates to the contextual factors that contribute to Sonia's professional development. No article that I have come across focuses on knowledgeable prospective teachers like Sirpa, who also uses contextual factors like in the case of Sonia. Therefore, this thesis could contribute with an understanding that can be linked to prospective teachers who regard themselves as somewhat successful in relation to mathematics and how they use their experience in their present participation in teacher education.

The research gaps

The study of prospective teachers' participation and prospective teachers' identities in relation to mathematics teaching is slowly becoming an increasingly important research area. It is generally accepted that identities are situated and therefore multiple, drawing on experience from many different places even those outside the educational sphere. However, very few studies take into consideration this "outside" aspect and allow experience from social practices other than the mathematics teacher education to contribute to the development of prospective teachers. This study does not restrict itself to mathematics teacher education, as it does not regard mathematics education as the sole contributor to the development of a teacher. There is a need for research

that allows for aspects other than the mathematics education itself to be considered and reflected on. This study is an attempt to take into account the whole surroundings of the prospective teacher as a way of trying to understand how different experiences are related to each other, if at all.

There is a lack of research related to prospective primary teachers with a special interest in mathematics, mathematics teaching, mathematics learning and who regards themselves as knowledgeable/proficient in mathematics. The lack of literature in this direction reflects the deficit mentioned earlier, and can be seen as an example of the commonly shared understanding of a primary prospective teacher and teacher lacking interest and/or knowledge in mathematics specifically. This study has a substantial gap to fill – to present how prospective teachers who regard themselves as interested and knowledgeable in mathematics perceive their educational experiences. The study is important because it illustrates what is beyond the commonly shared "understanding" of a prospective teacher attending mathematics teacher education courses. To gain insights about experiences from teacher education *and* other relevant past, present and future social practices in relation to the development of prospective generalist teachers, their own imaginings of themselves as emergent primary mathematics teachers are essential. An important gap in relation to this is the question of how prospective teachers may be constrained in their development by aligning with the performative culture from their past as well as the prevailing deficient story of today's society.

There is a need to develop understandings about what happens along the way when becoming a teacher. What experiences of the teacher education programme and other relevant social practices are visible in prospective teachers discursive engagement? To understand professional development/identity development is regarded as a complicated process that requires long-term engagement from the researcher. This study sets out to describe a complex experience during teacher education and the mathematics education course specifically. Most importantly, it strives towards an understanding of how teacher education frames this process in close relation to the prospective teachers' perspectives. Few studies give a thick description of the process of becoming a teacher, and there are very few studies conducted in a Scandinavian setting, of which none are relevant to the cases in this study. The cases in this study, that of Evie and Lisa, can give unique insights about how prospective teachers who regard themselves as mathematically proficient experience teacher education.

Through considering the "outside" as well as the interested primary prospective teachers and the in-depth descriptions of the process of becoming a teacher, this study situates itself within the 'learning for participation' metaphor. This means that it relates to prospective teachers' identity development.

The basis for doing this study is the need to consider the "outside". An evident gap in research can be filled by the understanding that derives from listening in to the critical cases that are presented. Regarding the research communities' request for in-depth longitudinal descriptions of processes that evolve during the teacher education, this study will hopefully provide new understanding.

Theoretical directions and concepts

This chapter presents and justifies the theoretical perspective of the study. The intention is first to present how this study has conceptualised the conceptual framework, Patterns of Participation, followed by a presentation about the nature of research in different paradigms. Finally, there will be an elaboration and justification of a set of assumptions that are important for conceptualising the theoretical perspective.

The theoretical perspective is the chosen view used to understand and proceed with the research process, which means that the theoretical perspective is meant to guide the logic within the thesis as a sort of main criteria for the process of research (Gee, 2011). The theoretical perspective includes pre-defined concepts and assumptions that guide ideas and the research design (Eisenhart, 1991). Thus, this chapter about theory sets standards for the methodology and the result, as they are intimately connected.

Sometimes a framework is compared to the lens through which we understand and conceptualise the process and product of research (Benton & Craib, 2011). A framework is used to support the study, to give it structure and guidance. A researcher can choose among different frameworks: theoretical, practical or conceptual. According to Eisenhart (1991), the *theoretical* framework uses a formal theory to establish explanations about a phenomenon. A *practical* framework guides by finding things that work in practice. And one can regard a *conceptual* framework as a skeleton that justifies the study in relation to the aim – a set of assumptions about reality that underlies the research.

The conceptual framework, Patterns of Participation

This section sets out to explain what a conceptual framework means for this study and furthermore explicitly elaborate on the particular conceptual framework used in this study.

A conceptual framework

This study uses the conceptual framework, Patterns of Participation (Skott, 2013, 2015, 2018). Eisenhart (1991) and Lester (2005) point out how a conceptual framework is to serve as a justification for the research process. In her article, Eisenhart (1991) relates the use of a conceptual framework to research that aligns with a certain way of doing ethnographic research. She puts emphasis on three essential steps concerning the ethnographic research process. As explained in the following, the conceptual framework is important for the last two steps.

1. What is the phenomenon of interest in this specific study, and how can it be explained? This should be clear by reading the main aim of the thesis. In the main aim, the researcher should identify a clear research gap. However, the research interest in itself does not determine the theoretical direction of the study. In this thesis, the introduction and literature background exemplify the phenomenon of interest and present a research gap.
2. The researcher chooses an explicit conceptual framework. The conceptual framework of this study is Patterns of Participation. The selection of a framework is decisive for how to conduct the process of research and what findings the researcher presents in the end. This chapter is set up to justify the conceptual framework.
3. The last step is a methodological consideration concerning how to reduce the created empirical material into meaningful data. It is a process I refer to as generating data that the researcher uses when writing the Results chapter. The generated data should align with how the study has conceptualised the conceptual framework. To explain this process is the aim of the next chapter concerning methodology.

The conceptual framework usually involves inspiration from different sources, and therefore, there is a need to justify what these different sources will contribute to and what their relationship is (Eisenhart, 1991). Concerning this, Lester (2005) points out that it is not solely to choose and use a conceptual framework, but rather every researcher needs to adjust and justify the conceptual framework in relation to the specific study. Researchers must be able to present, exemplify and demonstrate to oneself and to others that the results follow from the data because of the use of a conceptual framework.

Patterns of Participation

This thesis started with an interest in professional identity development. The conceptual framework of Patterns of Participation can be used to interpret the construct of this precise area of interest. Through the conceptual framework, Patterns of Participation, Skott aims to accomplish three things. First, he aims to reduce the emphasis on objectifications in research about prospective teachers and teachers. Second, he attempts to re-centre the prospective teacher and teacher in research. And finally, he tries to re-conceptualise what are known as beliefs, knowledge and identity in participatory terms. In this quest, Skott (2015) points out that the conceptual framework of Patterns of Participation focuses on the pre-reified processes that precede, and give rise to, what others term 'beliefs', 'knowledge' and 'identity'. In relation to the aim of this study, the emphasis on reducing objectifications and re-centring the teacher correlates with my interest in the prospective teacher's "imaginings of themselves as teachers-to-be". Becoming a primary teacher is a process – a continuous flow of events that emerge during one's teacher training programme and can be related to pre-reified processes, to use Skott's terminology.

In Lerman's (2013) view, Skott makes an important move when focusing on the emergence of the situation – the process. He terms the Patterns of Participation framework 'an emergent approach': "This dynamic process is studied through eliciting the teacher's interpretation of what she does in classrooms and how that relates to her prior engagement in other social practices" (p. 625). Any social practice produces social life and human lived experience through activities, social relations and discursive moments (Chouliaraki & Fairclough, 1999). All social practices offer a discursive arena where the individual assembles discursive patterns. In this study, *discursive* is defined as how a person transforms past experience into the present situation and how a person transforms utterances from one discursive arena to another (Gee, 2004).

Patterns of Participation can focus on any relevant practice (Österholm, 2011). To focus on any relevant practice is in line with Morgan (2012), who explains that we need to look outside the immediate social practice, in this case, teacher education, if we want to view what the teachers – in my case, the prospective teachers – bring to the situation. This correlates directly to the aim. Patterns of Participation includes, or does not exclude, non-mathematical and non-institutional experience. Skott (2018) is interested in any data "that point to any practice or figured world that appears to orient the teacher's action or meaning making as they relate to the profession…" (p. 615).

The conceptual framework, Patterns of Participation, is not solely used to describe immediate social interaction, as in, single events. Essential for this study is the description of how different events relate to each other, which is not to say that different events must necessarily relate to each other. The conceptual framework of Patterns of Participation shows how the different patterns relate to each other, if at all. By looking through the lens of the chosen conceptual framework of this thesis, it is possible to detect what Skott terms 'patterns of patterns' and see how they change over time.

Two main theoretical sources

According to Skott (2013), Patterns of Participation draws on two main theoretical sources, symbolic interactionism and social practice theory. My interpretation is that Skott uses concepts that focus on both the individual and the social practice itself in the Pattern of Participation framework.

Symbolic interactionism views humans as actors and reactors in situations and positions meaning as something that one engages in when experiencing things in the situation, on the spot. Humans respond to the situation by interacting with others and with the self, and by taking, or interpreting, the role of others (Prus, 1996). This creates a discursive pattern. Symbolic interactionism gives a focus to individuals' discursive participating in social practices. This will be elaborated later in this chapter in the section concerning Symbolic Interaction.

Social practice theory focuses on the practice per se. Giddens (1984), Holland et al., (1998) and Wenger (1998) highlight that social practices are ordered across time and space. Most important is how social practice theory stresses that it is through the engagement with different past and present social practices within communication that individuals understand the world around them when they, for example, engage in the teaching profession. Considering that social

practices are ordered in time and space allows for the research of complex patterns in multiple social practices.

In both symbolic interactionism and social practice theory, the notion of identity is central. Prospective teachers' continually evolving identities is the result of shifted participation in educational or non-educational discursive arenas. Social practice theory acknowledges that all activities are situated, and therefore identities are multiple. In line with Holland et al. (1998), I define and conceptualise identity in this study as the imaginings of self in [imagined] worlds of action. Imaginings of self are created in immediate social interaction through justification in relation to social practices and figured worlds.

Identities develop as a continuous process and are expressed in social practice (Holland et al., 1998). As a teacher-to-be, one constantly renegotiates the imaginings of selves in the world of actions. By contrasting the shifts in these imaginings during a longer timespan, one can illustrate shifts in identity.

According to Darragh (2016), to position any conceptual framework with symbolic interactionism is a delicate problem. When using a "Meadian" approach to identity, you need to keep away from an acquisitionist core. "Meadian" research also needs to keep away from constructivist connotations (Darragh, 2016). Concerning the conceptual framework, Patterns of Participation, Skott is very explicit. The Patterns of Participation framework sets out to describe the pre-reified processes that precedes and co-evolves, gives rise to, what is termed beliefs, knowledge and identity in participatory terms.

Contributing to the development of Patterns of Participation

During the early years of his research, Skott (2001, 2004) questioned the assumption that beliefs determine practice. He stated that a teacher's change to the profession is, and must be, an empirical question, not a premise so evident that researchers accept it as true without any inquiry. Skott (2001) developed a stance within beliefs research in which the social practice was given a more prominent role. When describing the uniqueness of a person's experience in practice, Skott began using the term 'school–mathematics–image', or SMI.

During an extended period, Skott (2001, 2004, 2009) tried to incorporate social elements into the research field of beliefs, but he started to shift away from the field as such, as indicated by his title, "Shifting the Direction of Belief Research: From Beliefs to Patterns of Participation" (Skott, 2010). In the years that followed, Skott (2010, 2011) embraced a participatory perspective making a

clear distinction between the acquisitionist and participatory metaphor used by, for example, Sfard (2008). As mentioned in chapter two, many researchers use the Learning as acquisition metaphor and the Learning as participation metaphor to separate constructive perspectives from social perspectives, and Skott used it specifically to distinguish his research from the beliefs research field.

Today, Skott (2013, 2014, 2015, 2018) tries to go beyond what is traditionally termed 'beliefs', 'knowledge' and 'identity' when understanding the role of the teacher and prospective teacher in the emerging social practice. Lerman (2013) and Österholm (2011) regard Skott's conceptual framework, Patterns of Participation, as a perspective that declines the dichotomy between Learning as acquisition and Learning as participation metaphors. They interpret that Skott today has no complementary ambitions such as trying to combine the metaphors, but that Skott rather relies solely on the participation metaphor. This thesis relies on the Patterns of Participation framework, and in the research process, I have come to renegotiate it. My hope is to contribute to the development and usefulness of the framework developed by Skott.

The nature of research in different paradigms

From the viewpoint of the philosophy of science, one can argue about how human behaviour should, or could, be studied and conceptualised. Two broad approaches can be recognised in this argumentation as an overarching dichotomy within mathematics education research (Lerman, 2000), other educational research fields (Benton & Craib, 2011; Prus, 1996), and other research fields (Halkier, Katz-Gerro, Martens & Hargreaves, 2011). These two approaches are social science relying on methods from natural science on the one hand, and more interpersonal and interpretive approaches on the other. These two give different answers to the questions of what it means to explain a social phenomenon and what a social phenomenon is (Patton 2002).

According to Benton and Craib (2011), the main approach in educational research related to the field of teacher change is research within social science using methods aligning with natural science. Such approaches have generally researched individuals' beliefs, attitudes, values or knowledge. One can regard beliefs, attitudes, values or knowledge as predictors of behaviour, where behaviour is seen as "the outcome of a linear and ultimately rational process" (Harrison & Davis, 1998, p. 2).

The reason to embrace the idea of studying human behaviour using similar methods to those used in the natural sciences is, according to Schoenfeld (2007a), to ensure that the research is scientific. Studies within this perspective often highlight relations between structure, conditions and outcome (Prus, 1996). David and Sutton (2016) describe the research goal in this perspective, the hypothetical-deductive method, to create logical conclusions from logical premises. Research communities related to this often use

> Data from experiments, surveys (questionnaires, census data), and other counting practices, these researchers are concerned with uncovering and specifying the structures, forces, or conditions that (they assume) cause people to act in this or that manner. Focusing on outcomes and variable correlates, they typically portray human behaviour in terms of dependent (outcome conditions), independent (causal), intervening (mediating conditions), and control (possibly confounding) variables. Aspects of the human condition are then represented in the statistical relationship by which these researchers define particular sets of (rate-based) data. (Prus, 1996, p. 8)

Hegemonic structures within social science research communities rely on natural science as being "more scientific" than other social science communities (Bryman & Nilsson, 2011). Historically, these communities have represented the main obstacle to the development of other alternative approaches that are more interpersonal and interpretive (Benton & Craib, 2011; Morgan, 2010; Prus, 1996).

However, in mathematics education, research perspectives relying on methods and thoughts from natural science have been challenged in many ways during the last decades. For example, Barwell (2013), Lerman (2000), Morgan (2010), Sfard (2008) and Skott (2013) all bring critique to the fore in terms of using perspectives linked to natural science. These perspectives are often regarded as individual and do not take enough account of the interpersonal and situated aspects of human behaviour as it emerges in, for example, the mathematics classroom or lecture hall. Prus (1996) emphasises that relying on natural science when researching human behaviour leaves no or little place for human meaning-making. As Blumer (1969) concludes,

> If one declares that the given kinds of behaviour are the result of the particular factors regarded as producing them, there is no need

> to concern oneself with the meaning of the things toward which human beings act; one merely identifies the initiating factors and the resulting behaviour. (Blumer, 1969, p. 3)

To be interested in how human behaviour evolves in, for example, the mathematics classroom or lecture hall is to point out that humans possess what is known as self-consciousness (Benton & Craib, 2011). Humans have the ability to problematise their experience and live their lives expressing meaning through language. Processes are then best understood within the social practices in which they emerge rather than within the natural sciences. This is sometimes related to what is known as the 'interpretive paradigm'.

Therefore, in this study, I consider an interpretive perspective on research and focus on interpersonal aspects when trying to understand the process of prospective teachers becoming upper primary teachers of mathematics. The interpretive stance in Patterns of Participation implies researching human lived experience differently than objects that can be measured statistically. In this study, an interpretive stance also implies that there is no intention to discuss cause and effect through different variables in relation to teacher education, but rather this study sets out to interpret human behaviour as human lived experience while humans attend social practices. These social practices offer discursive arenas where, for example, prospective teachers can negotiate their experience.

Set of assumptions and justification

This section emphasises the way essential notions and concepts related to the study are explained, defined and conceptualised within the study. The notions or concepts elaborated in this section are human lived experience, symbolic interaction, figured worlds and re-engagement as intertextual stratification. The importance of these notions and concepts in relation to this study emerged over an extended period. However, they are essential to the process of research, my understanding of Patterns of Participation, and in relation to the methodological tool explained in the next chapter. They present important aspects of how I have conceptualised the conceptual framework and adjusted it to this study.

Human lived experience

The Patterns of Participation framework focuses the researcher's attention to immediate social interaction – the day-to-day lives of humans. To be interested

in the everyday lives of humans is to be interested in human lived experience (Prus, 1996). The development process of the prospective teachers, Evie and Lisa, is intended to be written as a reflection of human lived experience, pre-reified processes. Therefore, using a conceptual framework that allows tales of human lived experience to be captured and presented is essential, as

> case stories written like this [in depth descriptions] can neither be briefly recounted nor summarised in a few main results. The case story is itself the result. It is a "virtual reality," so to speak. For the reader willing to enter this reality and explore it inside and out, the payback is meant to be a sensitivity to the issues at hand that cannot be obtained from theory. (Flyvbjerg, 2006, p. 239)

By focusing on human lived experience, this study situates itself in the middle of the sociological endeavour and embraces the idea that human behaviour is studied in relation to other humans. The intention, according to Patton (2002) and Prus (1996), is to study how humans become social entities by how they attend to each other and how they align with the quest of attending to their day-to-day lives.

This thesis focuses on the prospective teachers, Evie and Lisa, as they become upper primary mathematics teachers through the day-to-day encounters of their teacher education programme experience. I follow, observe, converse and interview them before, during and after various situations such as lectures, seminars, internships, study groups and examination work. I observe their participation in social practices when they become human lived experience. They are developing as future upper primary school teachers through their engagement in the social practice of, for example, teacher education, and my intention is to capture this development by telling their stories.

Symbolic Interaction

The conceptual framework, Patterns of Participation, draws on symbolic interactionism and describes symbolic interactionism as a micro-level theory that explicitly focuses on how individuals participate in social practices. The focus is on the symbolic meaning developed in social interaction, joint acts. In this joint act, meaning and identities are renegotiated. Symbolic interactionism offers many different possibilities in relation to methodology, for example, ethnographic research, case studies, discourse analysis, grounded theory coding, et cetera (Schwalbe, 1983).

The foundation of Symbolic Interaction heritage from George Herbert Mead and Herbert Blumer (Patton, 2002). They set out to study the way people make sense of human lived experience when engaging in activities (Prus, 1996). Symbolic Interactionism is an approach that carefully emphasises the day-to-day practice of people as human lived experience (Prus, 1996).

Blumer (1969) views Symbolic Interactionism as meeting three premises, methodologically:

- Human beings act towards things on the basis of the meanings that the things have for them.
- The meaning of things arises out of the social interaction one has with one's fellows.
- The meanings of things are handled in and modified through an interpretative process used by the person in dealing with the things he or she encounters.

Charmaz (2008) emphasises that Symbolic Interactionism today has high potential as a perspective in providing concepts and mind actions when researching 'social change'. This means that the analysis can start in a fine-grained manner with the intention to draw analytical conclusions on broader structures using theoretical concepts. The best analysis the researcher conducts is when the researcher has intimate familiarity with the field of inquiry. This is because lack of intimate familiarity also means a lack of understanding of the setting where the research is conducted. More specifically, intimate familiarity

> means looking, listening, and learning about studied life. It means sustained interaction with people and written data. It means experience wonder about their world, being willing to plunge into it, opening oneself to the unforeseen, and grappling with uncertainty. (Charmaz, 2008, p. 53)

Language

Language is considered fundamental in Symbolic Interactionism (Mead, 1934), which is described as an action in each situation (Blumer, 1969). In this situation, humans interact and make meaning in relation to each other. According to Mead, the world is symbolically and linguistically constructed. Language is both a product and a process of human interaction – or the symbolic

means of the sharedness of perspectives. Through interaction with others, the selves evolve while realities are created and transmitted.

Even though language and self are most essential notions in Symbolic Interactionism, the notion of language is not elaborated (Watson 2010). Schwalbe (1983) even implies that it may be taken for granted. Language is actual behaviour – one way of addressing a specific phenomenon (Watson, 2010). Of primary interest in Symbolic Interactionism is the question regarding what a person can do with language in a specific situation.

What people do and how they use language in immediate situations is related to the function language has in specific situations. According to Schwalbe (1983), this interest of the functional language coheres with Halliday's (1978) functional approach to language. Schwalbe even concludes that Halliday's functional view of language is "essentially congruous with Mead's view on language as a resource of symbols used by social actors to realise meaning potentials" (p. 292).

Meaning is given to us by others as we give meaning to ourselves. In this sense, Symbolic Interactionism focuses on language-in-use that is both related to experience from the past and the assembling of immediate interaction on the spot. Therefore, meaning facilitates actions. Later in the methodology chapter, this functional view on language – Systemic Functional Linguistics – will serve as a methodological tool to structure the created empirical material from fieldwork and interviews.

The self in Symbolic Interactionism

According to Blumer, Mead highlights that society creates self and that the "self" organises how we act in a particular situation. "The possession of a self converts the human being into a special kind of actor" (Blumer, 1969, p. 62). The self is not a static construction but rather an evolving process. Different situations allow us to participate in different ways, and persons choose roles in these situations – they choose, in some sense, how they will participate.

Mead (1934) emphasises human capacity for action as the "I". This "I" relates to the social self, me, and its recognition of itself as an object in a world of symbols, or other objects:

> It is through language, or significant symbols in linguistic forms, that a given social actor can 'take the role of others', can prefigure the result of

> his/her action from the other's standpoint and from that standpoint can treat him/herself as an object, the 'me'. (Watson, 2010, p. 306)

This phenomenon of recognising oneself as an object only comes about by trying to take the viewpoint of others. The viewpoint of others has an impact on our participation in the situation.

Gubrium and Holstein (2000) describe how "the self unfolds in and through social life, never separate from it" (p, 100). In this view, the self is situated to entities that surround us. These entities are termed slightly differently in different perspectives related to Symbolic Interactionism. For example, Gubrium and Holstein (2000) describe them as "going concerns" that one uses in interpretive practices. These going concerns relate to discursive environments that use a specific way of interpreting and representing everyday realities. Skott (2018) uses Social Practices and Figured worlds as defined by Holland et al. (1998) as "going concerns" when applying the Patterns of Participation framework.

Well aware of the fact that some researchers separate the notions of self and identity from each other, this study views the self within Symbolic Interactionism as a situated phenomenon where self and identity are synonyms, in line with Holland et al., (1998).

> Holland and colleagues use self and identity interchangeably as the dynamic relationship between the symbolic meaning systems of figured worlds and individuals' positionings in their everyday social encounters. (Skott, 2013, p. 551)

Figured worlds

Figured worlds is an essential theoretical concept in this study. Holland et al. (1998) describe a figured World as:

> A socially and culturally constructed realm of interpretation in which particular characters and actors are recognized, significance is assigned to certain acts, and particular outcomes are valued over others. Each is a simplified world populated by a set of agents who engage in a limited range of meaningful acts or changes of state as moved by a specific set of forces. (Holland et al., 1998, p. 52)

Any figured world has (1) recognisable characters and actors that (2) act in a specific way because of (3) shared values.

Figured worlds are experiences that guide us in discursive engagement. Gee (2011) explains that figured worlds are stories that we use to understand and interact with the world. We use experience from past and present social practices and figured worlds as building blocks in immediate social interaction (Gee, 1999). Immediate social interaction can be seen as a discursive moment where a situated pattern occurs, a discursive pattern. Discursive engagement will later be elaborated both in relation to the conceptual framework as re-engagement and engagement in social practice and figured worlds and in relation to the methodological tool, explaining how the re-engagement is intertextually constituted.

A figured world can be thought of as a cultural phenomenon that one can engage in, which is socially organised and reproduced and distributed between people. Figured worlds are regarded as global cultures, and their meanings are circulating amongst people. In this regard, figured worlds are processes that shape and form discursive patterns, and in discursive moments, one recognises oneself and others. Figured worlds are thus vital because they extend beyond the social practice itself.

A figured world is therefore not owned by individuals, but rather individuals contribute to its development. A figured world is a cultural phenomenon as real as any social practice. It is a social reality where identities enact. Any figured world has objectified meanings, joint activities, a structure of power and influence over humans. However, there is one main difference between social practice and a figured world (Skott, 2018). A figured world "may gain a social existence for the individual without her or his involvement in the re-negotiation of the meaning of the broader enterprise" (Skott, 2018, p. 5).

Figured worlds supply meaning in any discursive arena and are manifested in discursive engagement in social practices. They are historical phenomena that we use in processes of participation, with positions that evolve and stratify within a culture.

Frameworks, like Patterns of Participation, that incorporate figured worlds illustrate both the individual and the world they encounter (Horn et al., 2008). Therefore, the notion of figured worlds makes the Patterns of Participation framework the comprehensive framework that Österholm proposes. Patterns of Participation considers the prospective teacher as participating in social practices and figured worlds as the unit of analysis.

Re-engagement as intertextual stratification

In my interpretation and conceptualisation, the Patterns of Participation framework recognises that social practices are ordered and stratified across time and space. Discursive engagement is inextricably related to the social practice where it is historically and presently created. That something is stratified means that it is arranged (in strata) in a series of layers, levels, or gradations in an ordered system. It is not a static system. It situates through the function language has in every situation (Halliday & Hasan, 1989), how any present social practice historically connects to other social practices from the past.

From the perspective of social practice theory, individuals are perceived as active agents that purposely negotiate or renegotiate a range of other social practices – layers of social practices – in each situation in their day-to-day life. We use stratified experience when trying to understand the world, for example, when language is used to organise oneself around other people. This means that language has a function in relation to a specific situation (Halliday & Hasan, 1989). This phenomenon is termed re-engagement and engagement in social practices and figured worlds in terms of the conceptual framework (see Fig. 3).

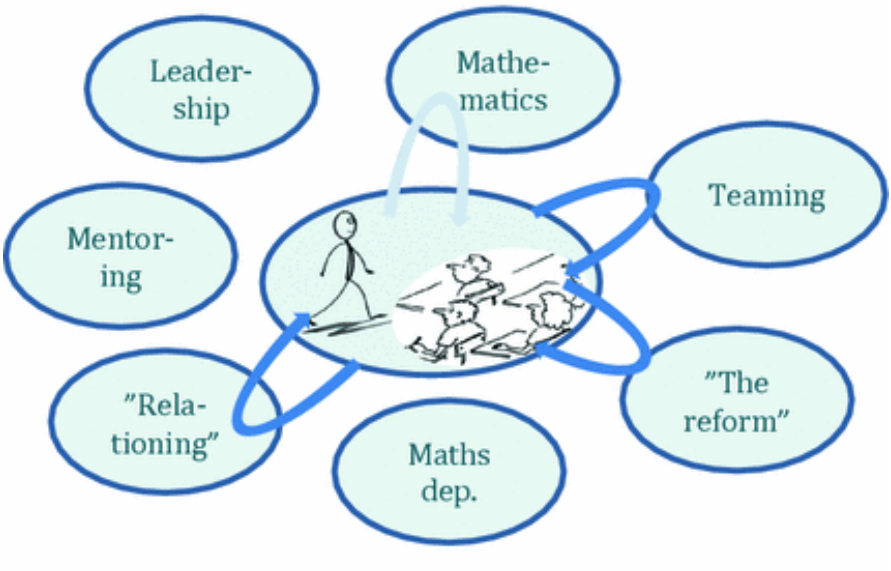

Fig 3. Skott (2018) depicts re-engagement to exemplify when a teacher uses/draws on other social practices and figured worlds in classroom interaction.

Earlier, it has been pointed out that social practices relate to experience from different places and times, experience that has evolved over an extended period and is stratified in time and space. In this study, intertextuality and stratification slowly emerged into important notions, as they relate, in my interpretation, to the conceptual framework and the research design as well as the methodological tool. Re-engagement is thus conceptualised and analysed as intertextual stratification.

The notion of intertextuality refers to Bakhtin's dialogism which highlights how language lies on the borderline between oneself and others and that language contains many voices, one's own and that of others (Allen, 2000). This is also known as 'heteroglossia'. Barwell (2013b) emphasises that "heteroglossia is an important aspect of [Bakhtin's] dialogicality, since it is variation that leads to the continual interplay of different ideas, perspectives and meanings" (p. 75). The most important thing is that "heteroglossia is a plurality of relations, not just a cacophony of different voices" (Holquist, 2002, p. 89).

In my interpretation, to make visible and describe this plurality of relations lies at the core of Patterns of Participation, but it is also important to make visible how these pluralities of relations change over time. This study uses intertextuality as a visualising or thinking tool to explore inter- and intra-cultural dynamics. This can be described as a way of highlighting the mosaic of intertextual relations (Orr, 2003). To interpret those intra-textual relations and to discover their meanings is one of the main aims of discursive research (Allen, 2000; Gee, 2014).

Therefore, the ideas of intertextuality and stratification are important in this study. They make it possible to explore the mosaic of intertextual relations in its full complexity, focusing how meaning exists between different discursive arenas. In this regard, identity is viewed as imaginings that contain a discursive pattern that is justified in relation to different social practices and figured worlds of both today and the past. Individuals' interpretations of a situation emerge as they interact (Gee, 2011), intra-personally as well as inter-personally (Sfard, 2008). Our present understanding is interwoven with our prior experience, as every act of language is interwoven with prior lived experience (Orr, 2003).

Discourse analysis and Patterns of Participation

In this chapter, several connections are made to different discursive research directions. This section focuses on not only understanding these connections between the traditions but also highlighting the differences between them.

Language as functional in an emerging social practice

Most discursive research directions regard language as functional – that language is situated and has a specific function in specific social practices. The main reference to the functional view of language relates to Systemic Functional Linguistics (SFL) (Halliday & Hasan, 1989). Halliday studies the relation between a discursive moment and the situation in which the discursive moment is embedded. SFL sets out to make visible intertextual connections embedded within a discursive moment by analysing the function of the language.

Critical Discourse Analysis, CDA, (Chouliaraki & Fairclough, 1999; Fairclough, 2010) draws partly on Halliday's view of language as functional using Halliday's SFL as a methodological tool when analysing the conjuncture of specific social interactions (Chouliaraki & Fairclough, 1999, p. 61). Other discursive approaches, like that of Gee (1999, 2004, 2014), also view language as functional and emphasise intertextuality in the way meaning is assembled. In discursive psychology, Potter, Wetherell, Gill and Edwards (1990) set out to describe discourses at work. Discourse at work is the constitutive part of social practice and is always situated within a "specific" practice where it has a particular function.

Intertextual building blocks and their importance

A recurrent theme in Discourse Analysis is how present discursive patterns relate to histories of the past. Experience is used intertextually in immediate social interaction.

> Intertextuality is viewed in CDA as the property texts have of being full of snatches of other texts, which may be explicitly demarcated or merged in, and which the text may assimilate, contradict, ironically echo, and so forth. (Fairclough 1992, p. 84)

Text is the outcome of a discursive moment. In CDA, these passages of other texts that are within a text are termed 'Theoretical or Social Practices' (Chouliaraki & Fairclough, 1999; Fairclough, 2010). In immediate social

interaction, people use theoretical and social practices as material. Theoretical practises are experiences as we recall them, and the "raw material" that contributes to these theoretical practices are other past experienced social practices (Chouliaraki & Fairclough, 1999).

CDA analyses the conjuncture of the theoretical and social practices. This means that the analysis of the discursive moment provides access to the combination of the theoretical and social practices, illustrating the combination of practices that are within the text. The main focus is to use the combination of events to specify "how much of a part and what sort of a part discourse plays in the practice" (Chouliaraki & Fairclough, 1999, p. 61).

Gee emphasises that intertextual units are created from a diversity of features: "The assembly process is guided by, and, in turn, helps to transform and change, a cultural model that explains (often partially and sometimes inconsistently) why and how certain assemblies are linked to certain sorts of contexts" (Gee., 1999, p. 47). Gee (1999) uses the notion of 'assemble' when explaining how interaction unfolds. To assemble means literally that things are drawn together. Important for Gee is that this assembling of meaning is created "on the spot" in immediate social interaction and that assembling patterns are created in that moment (Gee, 1999). Later, Gee (2014) uses the notion of intertextuality when describing this assembling process, that is, the relation between immediate social interaction and how it relates to other discursive moments from other social practices. His main interest is in the features of the specific assembly and how they relate to social practices.

Wetherell (2006) stresses that when discourses are at work, humans use the evolving discourse and so-called interpretive repertoires in immediate social interaction. Interpretive repertoires are used within discursive psychology to summarise global patterns in humans' meaning making. They are broadly recognisable routines to identify specific discourses. Interpretive repertoires are the intertextual building blocks used discursively where identities and social life are constituted (Wetherell, 2006).

There are no significant differences between how different proponents of Discourse Analysis use the notion of intertextuality; nevertheless, they use different terms for the building blocks.

Contrasting

When comparing the conceptual framework Patterns of Participation with discourse analysis, many aspects are similar. For example, the main aim of Patterns of Participation to illustrate prior engagement in a range of other social practices aligns with Chouliaraki and Fairclough's (1999) "analysis of conjuncture", Gee's (1999) "assembling of meaning" and Wetherell's (2006) global patterns built up from intertextual building blocks. Another example is that Patterns of Participation and discourse analysis in themselves have no a priori understanding of the social practice. They consider any social practice that is evident in the analysis. My interpretation is that a framework like Patterns of Participation that draws on symbolic interaction has an implicitly functional view of language and that intertextuality "lurks beneath the surface". In my interpretation of Patterns of Participation, intertextuality thus becomes a fundamental concept.

However, there are differences between Discourse Analysis and the Pattern of Participation framework, despite noticeable similarities. Skott's interest as well as this interest of this study goes beyond the conjuncture, the assembling itself, or the categorisation concerning discourses, to focus on the participants in relation to the social practices that are within the immediate social interaction. While Patterns of Participation re-centres the prospective teacher – puts the prospective teacher in the foreground – discourse analysis foregrounds the discourse itself. However, there is one important difference between the two perspectives – the focus on the 'I' within Patterns of Participation, meaning the focus on the individual in the discourse rather than the discourse itself. The 'I' can be described as a bricoleur that builds up the language by assembling the pre-existing material. A person orchestrates and arranges language by using elements, approaches, and forms from other sources (Holland et al., 1998).

Therefore, the main difference between CDA, DA, Discursive Psychology and Patterns of Participation is that Skott's interest lies in how the different social practices are connected discursively, as they belong to a specific prospective teacher, and how these discursive patterns change over a long period of time. The pattern that the researcher creates through the analysis, how the intertextual parts in the pattern are connected, how patterns evolve during the time is important in Patterns of Participation. These aspects are considered vital when trying to understand the individual prospective of teachers rather than the discourse itself. Social practices and figured worlds identified within a

discursive moment are essential. The prospective teachers use these experiences in their re-engagement in the past, present, and imagined future social practices and figured worlds. The framework chosen for this study makes it possible to "understand how a [prospective] teacher's interpretations of and contributions to immediate social interaction relate dynamically to her prior engagement in a range of other social practices" (Skott, 2013, p. 549) and figured worlds (Skott, 2015).

This study views 'discursive' as a moment of social practices where people renegotiate their experience. One may get the impression that this study undertakes discourse analysis without focusing explicitly on the discourse, but that is not the case or intention. Rather, the focus is on the prospective teachers who attend different social practices linked to teaching and learning mathematics. In this thesis, discursive *relations*, not the discourse itself, are in focus, which implies the dynamic analysis of the emergent teachers rather than discourse analysis. My interest is to understand how different social practises influence and relate to other social practices rather than a primary interest in discourse. However, Barwell (2013) claims that discursive approaches are "highly sensitive to fine detail of classroom life" (p.605), and therefore, the subtle details that can be perceived through a discursive approach are important in relation to my interpretation of the Patterns of Participation framework.

To conclude, Patterns of Participation focuses on how social practices and figured worlds overlap and merge in immediate social interaction (Skott et al., 2011), with a particular focus on their intersection (Gubrium & Holstein, 2009) and how they are related and connected. In this sense, multiple practices are indicated, and intersections must be discussed not only in relation to the present situation but also in relation to the past and future social practices and figured worlds highlighted within the present situation.

Theoretical elaboration on the aim

Based on the theoretical direction and essential notions related to this study, the overall aim of this study is adjusted. The overall aim then is to contribute with insights about how, or even if, experience from teacher education and other relevant past and present social practices and figured worlds matter for prospective generalist teachers' imaginings of themselves as primary mathematics teachers-to-be.

Prospective teachers' discursive moments are fluid and dynamic. They are "imaginings of self in [imagined] worlds of action", which is conceptualised as the identities of the prospective teachers in this study. Identity is understood as imaginings about oneself that contain discursive patterns that are justified in relation to other social practices and figured worlds.

Other relevant practices include those related to the teaching and learning of school mathematics as well as social practices that are neither mathematical nor institutionalised.

Research questions

- What engagement and re-engagement from teacher education and other relevant social practices and figured worlds are visible as intertextual parts in prospective teachers' imaginings about themselves when developing a teacher identity?
- How are these different social practices and figured worlds intertextually stratified?
- How do prospective teachers' patterns of participation develop during parts of teacher education; that is, what are their patterns of patterns?

This chapter has presented the conceptual framework, Patterns of Participation, laying the theoretical foundation. Patterns of Participation focuses on the pre-reified processes that precede and give rise to what others term 'beliefs', 'knowledge' and 'identity'. In this chapter, I also explain how I have adjusted and conceptualised the framework in relation to this study. Taking this theoretical direction, I later present two cases of prospective teachers' identity development. These are based on the participation of two prospective teachers in teacher education as well as the experience they gained elsewhere.

Methodology

Methodology, in this thesis, can be understood as methods used for creating empirical material and the specific reasons for using such techniques. Furthermore, methodology concerns aspects of how the created empirical material was transformed into data material and how the selection of data material was used when preparing to narrate the result (Skott, 2018). This explains why the specific chosen transformed data material was relevant to this study.

The process of transforming created empirical material into data material was done in two steps. First, the created empirical material needed to be structured and organised. This was done by applying a methodological tool. This methodological tool, Systemic Functional Linguistics, is presented later and concerns the function language has in the specific situation.

Second, the framework, Patterns of Participation, was used when generating data material to the Results section (see "Results: The tales of Evie and Lisa", p.101). This involved the process of selecting relevant information that highlighted patterns or discursive patterns in prospective teachers' participation. The framework was also used later to produce tales from the generated data material as well as when linking several episodes together in relation to the prospective teachers' becoming. Different patterns, within and between the tales related to Evie and Lisa, were considered and the so-called patterns of patterns emerged.

Therefore, this chapter focuses on the research design – the process of choosing methods for gathering information, structuring information, and generating data material for the Results section (see "Results: The tales of Evie and Lisa",

p.101), presenting the result and linking episodes together within and between the two prospective teachers to, in this case, highlight shifts in prospective teachers' patterns of participation. In addition, the chapter discusses conducting research on how to approach the prospective teachers' perspective, the reading of this thesis, and ends with highlighting different quality aspects of the research process.

Literature review

The literature presented in chapter "Becoming a teacher during teacher education" was collected in different ways. Concerning research about beliefs and mathematics knowledge, for or in teaching, the main parts of the literature used were found in relation to participation in different topic groups that were related to teachers' beliefs, knowledge and identity. For example, much of the literature was found through their participation in the CERME conference (Congress of European Research in Mathematics Education), MAVI conference (Mathematical Views) and the PME conference (Psychology of Mathematics Education). However, even though identity as a topic was situated within these topic groups, there was a lack of papers/research reports concerning identity development. Therefore, a systematic search for literature regarding identity development was conducted.

The databases that were searched were PsycINFO, ERIC and WEB of Science. The search in all three databases included ((identity) AND ("teacher education" or "mathematics education")) AND ("student teachers" or "preservice teachers" or "prospective teacher"). The first search in PsycINFO generated 16 articles, of which six in some sense related to this study. The second search was done in Eric and generated 20 articles of which four were new to this study. Finally, I searched Web of Science. This search generated 35 articles, of which four were new in relation to the two other databases. In total, 14 articles were specifically related to identity, mathematics education, and prospective primary/elementary teachers. All the articles used in this thesis have been peer-reviewed.

Ethnography

Social practice theory and Symbolic Interactionism direct attention to the day-to-day lives of people. In this thesis, this correlates to how the two prospective teachers, Evie and Lisa, live their lives through teacher education. To be

interested in their day-to-day lives implies methods for gathering information from which it is possible to observe immediate social interaction. In-depth cases lead to rich and hopefully nuanced descriptions that may be valuable for understanding a phenomenon (Flyvbjerg, 2001). Flyvbjerg (2001) even argues that there is potential for generalisability if the research is conducted with attention to specific critical cases. This is different from relying solely on questionnaires and interviews, and I am well aware of the criticism that this type of research is limited when it comes to the possibilities to generalise across settings. This is an objection often raised by perspectives within social science that rely on methods from natural science.

One way, among others, of investigating human lived experience from the perspectives of people who are in the situation, is an ethnographic approach (Prus, 1996). Aspers (2011) and Palmér (2013) emphasise that ethnography sets out to understand and interpret the meaning people attach to different experiences and how they are related. Ethnography is closely associated with symbolic interactionism by the work of Charmaz (2006) and Prus (1996) and social practice theory by the work of Holland et al. (1998). Holland and Lave (2009) define ethnography as the focus on persons while they attend local practices and long-term institutionalised struggle. It is a "way of looking at, listening to and thinking about a social phenomenon" (Palmér, 2013, p. 66) that is of interest; in this case, this social phenomenon is the process of becoming an upper primary teacher.

Although traditional ethnography has been more descriptive, today theory plays an essential role within ethnography. Theoretical insights inform the interpretation of the created empirical material and selected data (Wilson & Anmole, 2009). Therefore, theoretical concepts are used to make sense of the empirical world. In their response to current debates about theory in ethnographic research, Wilson and Anmole (2009) promote that in "some ethnographic studies the theoretical insights are neither strictly deductive nor inductive, but represent a combination of both. We might venture to say that the most creative ethnography reflects this synthesis" (Wilson & Anmole, 2009, p. 562–563).

Being within the social situation as a researcher is, according to Prus (1996) and Christensen (2004), the only reasonable way to understand the processes of becoming or processes of learning. This means that the ethnographer, in this case, tries to make sense of human lived experience by observing the situation,

asking questions about the situation observed, and conducting interviews about that which has been observed (Willis & Trondman, 2000).

Within ethnography, some underlying principles can be found when reviewing the research literature: being immersed in the society, having culture as a concern, generating information through fieldwork, using multiple methods when gathering information, searching for meaning from the members' points of view, and long-term engagement (Bryman & Nilsson, 2011; Walford, 2008). It is understood that these principles are present in many other perspectives as well, for example, case studies. However, I consider this to be an ethnographic study because I have perceived and thought of it as ethnography in the commitments that guided the research process. This is in line with Macdonald (2001).

Multi-sited ethnography

The main reason for choosing an ethnographic approach for this study was my desire to be able to systematically follow the aforementioned process. However, as discussed later in this section, following a process does not fall in line with the "classic" model of ethnographic studies, which set out to understand post-colonial cultures in the early twentieth century (Marcus, 1995). This challenges the general assumption that ethnography only concerns culture.

Culture as a phenomenon has been up for debate for an extended period concerning ethnographic research. Culture is no longer solely regarded as a colonial or local phenomenon (Eisenhart, 1991). Already during the 1970s, Willis' (1977) seminal ethnographic work, *Learning to Labour*, highlighted culture as a medium that could be used as material when interpreting the world. Willis was not interested in colonial or local culture but instead focused on what he termed 'countercultures'. A counterculture is a way of life that rejects "normal" values and ways of being a member in society. He describes countercultures as social groups formed by people in relation to their abilities to interpret symbolic articulations (Willis, 1977). Another example from the 1980s comes from Holland and Eisenhart (1990), who researched how women experienced college. They found that it was not the local culture at the college that made them fail or drop out but rather the global culture and circulated meanings of what it meant to be a woman that mattered to the individual. The phenomenon is discussed as the circulation of cultural meaning, which is emphasised both in Willis (1977) and Holland and Eisenhart (1990), and from

my point of view, is closely related to the notion of figured worlds (Holland et al., 1998).

In their ethnographic approach, Holland et al. (1998) focus on identity and agency in relation to practices and the kind of activities that are situated within the practice. They do this in order to understand people's actions and possibilities. Ethnography as a field of research has a focus on enculturation that reflects a specific cultural ideology. Sites of the self are plural. Today, the focus is more often on the "self-in-practice" than on the practice itself (Holland et al., 1998).

This has put new demands on ethnographic research (Marcus, 1995; Palmér, 2013; Pierides, 2010). Around the middle of the twentieth century, the initial interest in colonial culture shifted to local cultures (such as inner-city classrooms). However, Marcus also points out that during the late twentieth century it became possible for researchers to assume an understanding that processes of learning take place in different places. Therefore, ethnography slowly started to create what Pierides (2010) calls a "multi-sited imaginary" (p. 191). In this sense, ethnographic research is no longer solely organised around one site, or what in the past would be considered a single-sited ethnography.

Rabinow (1988) concludes that even though a social practice can be singular in content, every social practice draws on/relates to other social practices from the past. The phenomenon of interest appears in a set of different social practices that constitute larger complex domains of interest for research. Marcus (1995) emphasises that this suggests examining "the circulation of meaning, objects, and identities in diffuse time-space" (p. 96). The most significant benefit of the multi-sited ethnography of this study is that it makes it possible to follow processes outside the teacher education itself and search for other relevant social practices and figured worlds that contribute to the process of becoming a primary school teacher. Pierides (2010) highlights:

> The goal is not to represent what is inside peoples' heads but to narrate how things came to be. It is emergent, contingent, local, multiply implicated and thoroughly relational. In a move that can be described as '[crisscrossing] the cultural terrain in a variety of different ways'. (p. 190)

Presenting the ethnographic case in a narrative way

The main reason for presenting the results in a narrative ethnographic way is to fully engage in a specific research agenda that provides the reader with a feeling of human lived experience (Kaasila, 2007b) in order to describe the situative aspects (Bjuland et al., 2012; Hodgen, 2011) of the particular prospective teachers becoming teachers. However, the notion of narrative "carries many meanings and is used in a variety of ways by different disciplines, often synonymously with story" (Riessman & Speedy, 2007, p. 428). In this thesis, the notion should be understood in the broad sense, as this study is not a narrative inquiry.

The cases are primarily the result of a series of events. We are humans because we use narratives in our daily life to understand the world (Rosenblatt, 2002) and how we make connections between different events is important. Prospective teachers are viewed as humans with a past, present and a future and are described in this way in the Results section (see "Results: The tales of Evie and Lisa", p.101). Therefore, it is interesting to study how the prospective teachers make meaning out of certain events. Just as readers can be seen as active agents in the process of reading, this study highlights how prospective teachers are active when reading their own experiences and then combining these into a coherent narrative.

However, it is not only the prospective teachers who are active in the process of reading. This also goes for the reader of this thesis. The Results chapter makes visible the interplay between this thesis as a text and its reader. The understanding of a text is always situated in the act of reading. To read is to engage in a text based on the lived experience one has, and the lived experience of the reader thus moulds with the text. When reading a result produced narratively, the reader "will find in it according to what they bring into it" (Clough, 2002, p. 13). This means that the results presented in a narrative way also gives room for different interpretations.

Rosenblatt (2002) mentions two ways of engaging in the reading process: efferent and aesthetic reading. *Efferent reading* relates to the reading of scientific facts that lack personal, intuitive, creative and interpretive efforts. Efferent reading is described as an impersonal reading. In contrast, *aesthetic reading* offers scenes and situations that we almost can feel within ourselves. Large parts of scientific texts are meant to be read in an efferent way, as are several parts of this thesis, such as the theoretical background. However, the

case studies presented as tales become "impure" in style concerning efferent reading. Some might say that they are even non-scientific in style. Rosenblatt explains how case studies presented as tales contain parts that require efferent reading and parts, often the result, that requires aesthetic reading. This is important to be aware of when reading such a study.

Given that every reader of this thesis will have a different set of experiences to relate to, when presented as a narrative embracing the aesthetic reading, the same text will provide different readers with different meanings (Clough, 2002; Rosenblatt, 2002). This means that the result, the narrative, is not to be seen as a static object but rather a text that opens up to the reader's active participation. I do not free myself from the responsibility of making the interpretations when writing the results and say that it is all the reader's responsibility – I am responsible for the whole research process, but nevertheless, everyone will have slightly different experiences when reading this thesis.

This actually highlights the specific nature of the interpretative paradigm within which this study is situated, in contrast to studies with approaches from the natural sciences. The results of this thesis are meant to identify lived experience concerning the prospective teachers' past and to open up for discussions about different readers' interpretations. The results presented in a narrative cannot be neatly contained within a box. Every time one engages in a text, one finds new meaning (Clough, 2002; Rosenblatt, 2002), and that also includes me as a reader as well as Evie and Lisa as readers of their own narratives. Flyvbjerg (2006) describes results written narratively as a virtual reality that the reader can explore. This is seen as a possibility, not a weakness.

Critical cases in relation to this study

The two prospective teachers in this study were selected for several specific reasons connected to mathematics and mathematics education. They were chosen because of not only their commitment, experience and particular interest in mathematics and mathematics education but also because they themselves as well as the teacher educators perceived them as knowledgeable in mathematics. They were also chosen to ensure that the participants were regarded as critical cases (Flyvbjerg, 2006). The prospective teachers were considered interesting to the study, as they had both promoted the importance of mathematics and mathematics education during their education.

The choice of critical cases derives firstly from the highlighted concern that primary general teachers within their first years in the profession may not prioritise, or have the opportunity or ability to prioritise, the subject of mathematics itself (Palmér, 2013). If the prospective teachers who were chosen did not prioritise mathematics, then who else would? The political debate (Björklund, 2011), the union (LR, 2009), official reports (Utbildningsdepartementet, 2010), the media (SvD, 2010) and the research community (Askew, 2008) have, in general, described prospective teachers negatively, causing the research community and teacher education programmes to focus on the prospective teachers who lack interest and/or knowledge in mathematics. This results in a lack of research on the prospective teachers who are genuinely interested and considered knowledgeable in mathematics. The research community is more interested in prospective teachers who are not knowledgeable and seen as not adequately qualified to become teachers (Oliveira & Hannula, 2008). The prospective teachers within this study are not represented anywhere in this debate, even though the research community emphasises them as important. Therefore, they can be regarded as critical cases worth focusing on.

Introducing Evie

Evie was in her early 20s when she started teacher education directly after high school. She says that she comes from a family where mathematics has always been the primary school subject: "I come from a real maths family… everyone is interested in mathematics". Her mother and her father are proud that she wants to continue studying after high school, and they are especially proud of her decision to go into teaching. Evie emphasises that being a part of this study was her mother's suggestion. Her mother, who is an upper primary mathematics teacher herself, believes it is good for Evie to talk about educational "matters" with a researcher. Evie has always wanted to become a teacher.

During her education, Evie will study 30 ECTS credits (one full semester) of mathematics education, and before entering the teacher education, she had already written two independent 15 ECTS credits bachelor's theses in mathematics education (60 ECTS credits in total related to mathematics education) leading to a degree as an Upper Primary Teacher. Another sample criterion is Evie's perception of herself as a "good" mathematician when reflecting on her past educational experience at upper secondary school. During

the first interview and the rest of her education, she emphasises that Mathematics and Sports have always been her primary subjects of interest.

Introducing Lisa

Lisa is in her early 20s and also started teacher education directly after high school, but in contrast to Evie, she comes from a family where no one has studied at university at any level. In Lisa's family, it is customary for one to starts working at the local factory. Choosing higher education is not common. Lisa emphasises that, in general, her father and mother have limited experiences with school. They did not attend upper secondary school and began working directly after lower secondary. Therefore, her family is proud that she wants to continue studying after high school, and they are not surprised about her choice to do so given that she has expressed a keen interest in mathematics. Mathematics is sometimes discussed at home; however, this conversation is related to Lisa's father's work as a cashier at a local bank. Her father sometimes says that teaching mathematics today is done in an odd way that he does not understand. Apart from this, school-related questions are not discussed at home. Lisa describes herself as extremely competitive as an athlete and plays soccer at a high national level. Much of her terminology can be interpreted as related to sports and management.

Like Evie, Lisa will study 30 ECTS credits (one full semester) mathematics education. Before even entering teacher education, she made a choice to write at least one of the two (15 ECTS credits) bachelor's theses in mathematics education leading to a degree as an Upper Primary Teacher. Like Evie, Lisa also perceives herself as a "good" mathematician when re-engaging in her past school mathematical experience at upper secondary school. This meant that she too met an important sample criterion for the selection.

Accessing the critical cases

The prospective teachers participated in several educational situations. In these situations, other people were present. For example, during lectures, there were one or two teacher educators and approximately 28 fellow prospective teachers who also attended. In order to gain access to lectures, seminars and study groups, I followed three steps.

The first step was to describe the research intentions to the teacher educators in the programme. Two information meetings were held to explain why I needed to attend the entire 30 ECTS credits course in mathematics education. The

second step was to introduce myself to the whole group of prospective teachers and to gain access to the immediate social situation of the lectures. All the prospective teachers and teachers signed an agreement which allowed me to participate. The last step was to get access to the smaller working groups that surrounded the specific prospective teacher. When doing this, I met up with the study groups to explain the reason for my presence there. Later in the study, the prospective teachers expressed that during the first two working sessions they worked extra hard because I was there, but it soon became "normal work". They also discussed a lot of different things that were not related to the education itself.

Methods for creating empirical material

Prospective teachers' participation in a study like this is conducted out of their free will; therefore, the researcher needs to keep an open mind regarding how to create empirical material. The research agenda may be outlined in advance, but while creating empirical material, the researcher may need to change, for example, from writing field notes to conducting an informal interview. In this section, the different methods used in this study are presented. They are interviews, field notes from observations, audio recordings from lectures, seminars and working sessions, and collected documents concerning the prospective teacher and the teacher education programme.

The reason for using multiple methods is based on an assumption that different types of created empirical material contribute to different kinds of data (Prus, 1996; Skott 2014). Different methods enable the researcher to look at the same phenomenon from slightly different angles. This is also related to ethics, as using several methods together may also give information that, in the end, presents the prospective teachers in a more accurate and nuanced way. The methods used when creating empirical material must meet the requirements of capturing human meaning making. Together, the chosen methods need to be able to make visible group life as constituted by those present and interacting with each other (Prus, 1996).

Interviews as the primary source

The ethnographic research of this study draws upon interviews, some that were planned and structured and some that happen spontaneously in the situation. This means that some interviews in this study were conducted in a structured

setting and had a strong framing and some were not. Walford (2007) emphasises how the latter type of interview is sometimes more like a conversation, and therefore, not always audio recorded. This study contains both types of interviews. The prospective teachers were interviewed formally on a regular basis during the whole of two years and six months, and conversations were conducted mainly during the internship and the 30 ECTS credits course in mathematics education. Some interviews that were not planned were initially set up because things turned up in the process. All the interviews were transcribed shortly after they were conducted. The following is a short example of what the transcriptions looked like:

Researcher: Ok … then we begin … (mmm) many of the questions that I have today concern the internship … and other things around it and then we will see where we end up … (mmm) …in some way … you felt more secure … [yes] … much more determined.

Field notes

No clear advice could be found about how the researcher should behave when observing within an ethnographic study. However, Delamont (2008) considers five important questions for an ethnographer working with field notes. How do you observe, and what do you observe? What should be written down when making field notes, and in what way? And finally, how should the field notes be treated afterwards?

In these situations, you are either an active participant or a passive participant (Patton, 2002). However, it is important that the researcher only observes what goes on and refrains from judging. The researcher should try to write down what the participants attend to in the situation. This is related to the choices that the prospective teachers make in immediate social interaction. Delamont (2008) emphasises that "Good educational ethnography is not about hoping to see things that are 'striking' or 'noteworthy': it is about making the best description and analysis of what happens that one can" (p. 43).

Researchers' field notes can vary greatly because the notes must make as much sense as possible to the individual researcher (Walford, 2009). In this study, I have often followed the example of Delamont (2008) when arranging my field notes. She begins by sketching the room, making notes about where the focus of the room is and even what the walls look like. Influenced by Delamont's example, the following figure is an example of a classroom from the field notes of this study.

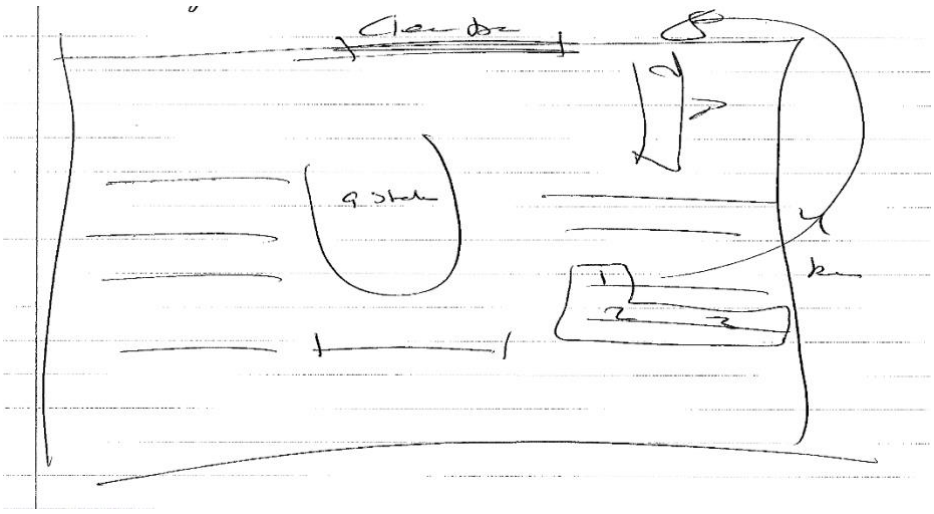

Fig 4. Drawing of a classroom.

After sketching the room, Delamont (2008) goes on to focus on the concrete things that happen. One of these things can be physical movement. According to Delamont, concrete things are those that will be hard to remember when later extending field notes from an observation.

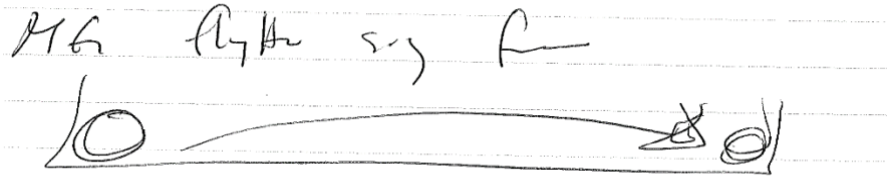

Fig 5. The positions of the supervisor during an observed lesson.

In this study, the observations relate to how the prospective teachers participate when studying as well as teaching mathematics, how they position themselves during activities related to mathematics and how they engage with the mathematical content during these activities.

During the process of creating empirical material in this study, field notes were used as a tool to explore the shared practice. In the specific notes, questions and topics have arisen that have been further investigated in, for example, interviews. The field notes were made during the internship and the 30 ECTS credits course in mathematics education. Along with the transcribed interviews, these notes guided the ethnographic research. Therefore, the observations were valuable, as they indicated phenomena that led the multi-sited approach into several other relevant social practices. The following is an example of field notes made during an observation from the second internship, followed by the extracted field notes written later the same day:

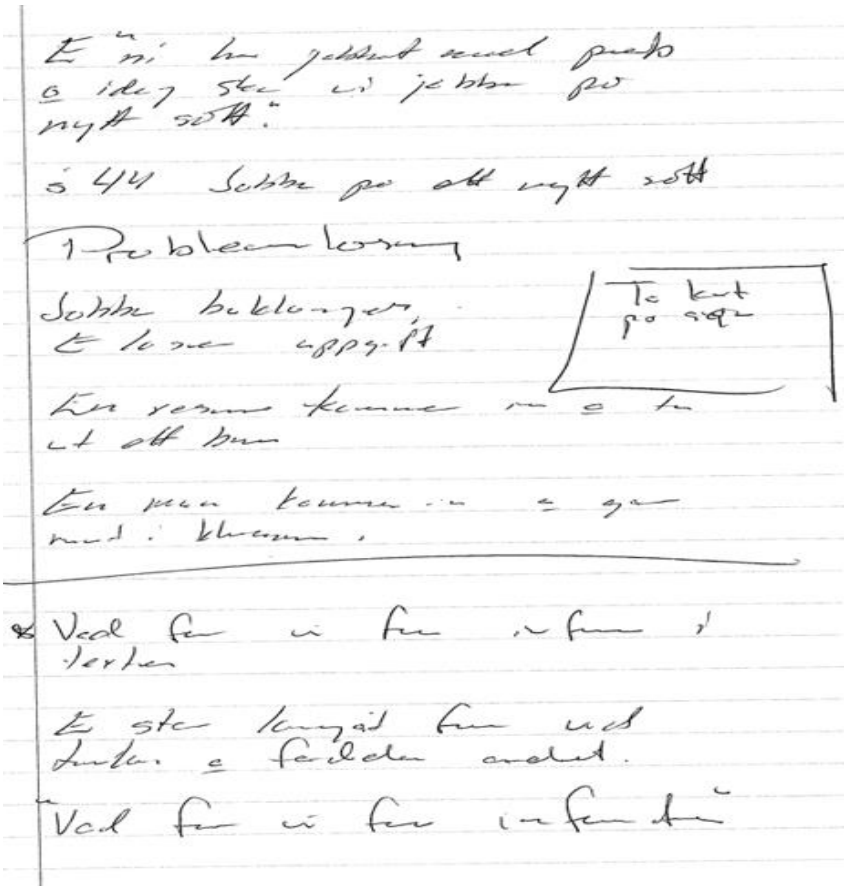

Fig 6. Field notes from 3 December 2013.

E positions herself in front of the class, and the class starts to lower their voices, a student comes in and says, “Math, yes” while a student whispers to another that mathematics sucks ... the class is silent, and the lecture is about to start. E is handing out mathematics textbooks and asks if someone has a copy in his or her bag. She positions herself once again in front of the class, and the class lower their voices once more. Now the internship supervisor enters the room and positions herself at the side of the classroom. E starts the lesson by saying “you have been working on problem-solving and today we are going to work in another way than before”. E keeps on in a distinct voice and describes that they will work with problem-solving, backwards and then she reads the task that is in the book.

She writes “PROBLEM-SOLVING” on the board. As she writes, a pedagogical resource comes in and picks out a child while another resource enters the classroom and begins to walk around in the classroom. E turns around and looks out over the class. She asks what information they get from the text.

E is standing in front of the class and directs the discussions and invites the students to speak up. She manages and chooses to listen to the answers and reasoning of different students: “What kind of information do we get?” Sometimes, some students say some wrong things. She sometimes ignores and sometimes chooses to listen to them, and then goes quickly to someone else. She is remarkably more secure in her role than before and in relation to the course moments. She is almost hard in her tone, standing with her back straight and visual in her body movements. E calls attention to when the classroom is too noisy, and the students lower their voices directly.

Audio recordings and collected documents

During this study, I have collected a range of documents. All lectures and seminars in mathematics education that the researcher attended were audio-recorded. All documents, PowerPoint presentations and materials that were used by the teacher educators have been collected as well as the prospective teachers’ assignments relating to the various lectures or seminars.

Overview of the created empirical material used in the study

Evie

Interview 1	Before entering teacher education, August 2011. For interview guide, see Appendix 4.
Observation	Three days during the first internship, spring 2012.
Interview 2	The third day of the internship, spring 2012. The questions mainly relate to the field experience and some follow-up questions from interview one. For follow-up questions, see Appendix 5.
Interview 3	Evie's mother, Angela, spring 2012.
Interview 4	Before entering the mathematics education course, December 2012. It mainly covers the view on teaching and learning mathematics, more specifically, on expectations of the mathematics education course.
Observation	The mathematics education course, spring 2013
Interview 5	At the beginning of the mathematics education course, spring 2013, individual questions extracted from field work.
Interview 6	Halfway through the mathematics education course, spring 2013. Contains individual questions extracted from the field work.
Interview 7	End of the mathematics education course, June 2013. Contains individual questions extracted from field work.
Observation	Three days during the second internship, October 2013
Interview 8	The third day of the internship, October 2013. The questions mainly relate to the field experience and some follow-up questions from the interview conducted during the mathematics education course.

Lisa

Interview 1	Before entering teacher education, August 2011. For interview guide, see Appendix 4.
Interview 2	Four weeks into the education, October 2011. An improvised interview.
Interview 3	The internship supervisor, Higgins, spring 2012. The questions mainly relate to the field experience and it contains some follow-up questions from interview one. For follow-up questions, see Appendix 5.
Observation	Three days during the first internship, spring 2012
Interview 4	The third day of the internship, spring 2012
Interview 5	Before entering the mathematics education course, December 2012. Involves mainly the view on teaching and learning mathematics and specifically on expectations on the mathematics education course.
Observation	The mathematics education course, spring 2013
Interview 6	Conducted at the beginning of the mathematics education course, spring 2013. The individual questions were extracted from field work.
Group interview 7	Group interview halfway through the mathematics education course, spring 2013. The study group sessions became an interesting social practice.
Interview 8	End of the mathematics education course, spring 2013. The individual questions were extracted from field work.
Observation	Three days during the second internship, October 2013.
Interview 9	The third day of the internship, October 2013. The questions mainly relate to the field experience and some follow-up questions from the interview conducted during the mathematics education course.

Each interview lasts approximately one to one and a half hours long. The internship observation were conducted during the students' regular school hours, which are approximately between 8.00–14.30. During these three days, the prospective teachers were responsible for at least four mathematics lessons that were observed as well as some other lessons.

During the mathematics education course, I attended 31 lectures, seminars, various examinations, or study group sessions. All of these were audio-recorded, PowerPoint presentations and other materials were collected, and field notes were written. This means that approximately 25 hours of interviews were transcribed, structured and organised in relation to this study. I spent approximately 100 hours attending the mathematics education course together with the prospective teachers and spent 12 full days visiting Evie and Lisa during their periods of internship.

While a lecture is for the whole class, a seminar is a meeting meant for a smaller group, referring to a formal educational group led by a teacher educator. A study group is a small group formed by the teacher educators which contains four to five prospective teachers. The work in the study group is carried out independently, and the teacher educators do not lead the work as they do in the seminars.

Using the methodological tool, Systemic Functional Linguistics

Österholm (2011) argues that the use of a methodological tool for structuring the information is essential when using the Patterns of Participation framework. In my case, the methodological tool needs to disentangle elements of the teacher education as well as relevant social practices and figured worlds in relation to different entities. These are experiences related to these elements of teacher education and other relevant social practices and figured worlds, the tense in which these experiences are described, the roles these experiences play regarding the degree of certainty, and the relationship between these different practices. The methodological tool should give access to finer details in the created empirical material (Jarowskij & Potari, 2009).

The tool chosen by the researcher should make visible intertextual relations for the complex purpose of Patterns of Participation. Juter (2011), Palmér (2013) and Skott (2015) try to meet this challenge by using different techniques related

to categorising that fall in line with Charmaz's interpretation of grounded theory in which empirical material is coded and compared. The use of grounded theory is expected to lead to practices and figured worlds beyond the classroom itself. Given that this focuses on experiences and figured worlds beyond the classroom, grounded theory may also have been an option for me. However, as indicated in the theory section, I have chosen another direction.

From created empirical material to structured information

For the purpose of structuring the information, Halliday's Systemic Functional Linguistics, SFL, was used. SFL views language as a resource that people use to accomplish specific purposes through expressing meaning in social practices (Halliday, 1978; Halliday & Hasan, 1989; Halliday & Matthiessen, 2004), and it highlights intertextual relations in the created empirical material.

Through functional analysis, SFL aims at uncovering why a speaker produces a particular wording rather than any other in a specific social practice. The answer is found in the text itself and through the relation between the text and other texts that are within the text (see Theory section and discussion concerning function of language). Holmberg (2012) points out that the texts within the text can be interpreted to contain three things: an activity, a situation or a social practice. These are related to past and present experience, which indicates that any text contains experience from a different time and space, and this is what makes a text stratified. Therefore, SFL relates in a straightforward way to the conceptual framework of Patterns of Participation. SFL offers a tool that can be used in relation to the understanding of participation in social practices (Nord, 2013; Halliday and Hasan, 1989). Holmberg (2012) suggests SFL as a tool that can be related to Lave and Wenger's social practice theory or Engestrom's Activity Theory, while Morgan (2006) uses the functional analysis with Bernstein's Pedagogical Discourse.

For this study, SFL offers a toolkit that makes possible the analysis of meaning at the clause level. This is in order to understand how social practices (such as teaching at the lecture hall) are reflected in the linguistic choices that participants make through discursive engagement. Every text reflects that it is about something (ideational metafunction), is addressed to someone (interpersonal metafunction), and uses a particular mode – spoken or written language, for example – to express its meanings (textual metafunction). An example of an SFL analysis will be presented later in this section.

The ideational metafunction

The ideational metafunction relates to how actions or experiences are articulated in the recorded material of the study through language in transcripts by observing the so-called transitivity systems. A *transitivity system* refers to how a person – in my case, the prospective teacher – relates to activities or objects through language. This can be reflected by observing the primary process verb of the clause (Halliday & Hasan, 1989). There are different processes that the transitivity system deals with:

- Material processes that involve physical actions such as competing, calculating, and teaching.
- Mental processes that involve thinking, wanting, enquiring, et cetera. It is the senser and the phenomenon that are in focus.
- Relational processes emphasise relations between objects.
- Verbal processes express something that has been said, for example, talk or something being mentioned.

The interpersonal metafunction

The interpersonal metafunction relates to voice, tense, polarity and modality. *Voice* refers to the personal pronoun in the text. It is important to consider that personal pronouns are not limited to people and can refer to social practices as well as figured worlds and other entities visible in the text. *Tense* refers to whether the proposition is valid for the past, present, or future. *Polarity* marks if the proposition has positive or negative validity through, for instance, the use of negations, for example, "I will" or "I will not". And lastly, *Modality* relates to the degree of certainty in an utterance.

> Modality signals uncertainty within a message and indicates a position between a definitive yes and a definite no. Often, the use of modal verbs indicates how much choice students have in a teaching and learning context. (Ebbelind & Segerby, 2015, p. 42)

There are many modal verbs within the transcribed interviews. However, specific attention was focused on modal verbs that indicate potential ("can"), alternative options ("will"), permission ("allow"), denied permission ("not allow"), something needed ("must") and future actions ("shall"). These were in focus because they are frequently used by the prospective teachers.

The textual metafunction

Finally, the specific social practice and language structures used to carry the meanings of the text are components of the textual metafunction. This function concerns the process of structuring the information conveyed. By looking at the theme and rheme, one can view how clauses follow each other in thematic bindings. When several of these thematic bindings occur, a lexical chain is created. This is also related to the use of conjunctions. Conjunctions show how different experiences are related to each other, creating not only connections in the texts under study but also disconnections. For an extended description of the metafunctions, see Ebbelind and Segerby (2015).

The analytical process

In the structuring of the created empirical material, I started with the interpersonal metafunction. In this part of the analysis, I first focused on the voice of the text by marking personal pronouns. I also marked imperatives because they reveal power relations within texts. Then I marked the tense to highlight if the proposition was valid for the past, present, or future. Thereafter, I marked the polarity to stress whether the proposition was about positive or negative validity. Finally, I marked the modality, which reflects the level of certainty a clause has. Specific modal verbs were marked. Modal verbs control and define common knowledge and refer to the level of certainty associated with particular forms (Herbal-Eisenmann, 2007).

In the next stage of the analytical process, I looked at the ideational metafunction where the process verbs were highlighted and classified through the transitivity system. Thereafter, entities or objects that were evident in the linguistic choices were also marked.

In the final stage of the analysis, the textual metafunction was applied to the text. Here, I started by marking the conjunctions and subjunctions. Conjunctions are words or phrases – for example *and*, *or* and *but* – that connect parts of a clause and clauses that are the same kind, combining two main clauses or two noun phrases. Subjunctions usually initiate a subordinate clause, for example, *because*, *as* and *when*. A subjunction introduces a dependent clause that often expresses a reason, a condition, a result or purpose, a time, or a contradiction. Next, the thematic bindings as theme and rhyme were observed in the lexical chains of the text. The lexical chain summarises how sentences are linked back to concepts that were previously mentioned or related to them. Lexical chains

highlight the linking of words that are semantically close or semantically related between clauses. The start and end of chains tend to correspond to changes of topic. Collectively, the words in a chain indicate a topic.

SFL offers a structured way of making visible intertextual relations. It provides a method of going deep into the functional structure of the text when later presenting the results in the Results section (see "Results: The tales of Evie and Lisa", p.101). However, foremost, it provides a way of structuring the information in line with the intention of the study and the conceptual framework of Patterns of Participation.

Using Patterns of Participation

Patterns of Participation seeks to understand how teachers' interpretation of and contributions to immediate social interaction relate dynamically to what Skott (2013) calls prior engagement in a range of other practices. Some patterns from the collected material have been observed in close connection to a few of Evie and Lisa's specific stratified experiences. However, most of the linguistic choices made by the prospective teachers in the study are re-enacted on several occasions. The different patterns can be contrasted, illustrating shifts in Evie and Lisa's participation concerning what they have experienced in different situations. There are also linguistic choices that are presented by both prospective teachers, and by analysing these, it is possible to compare their experiences.

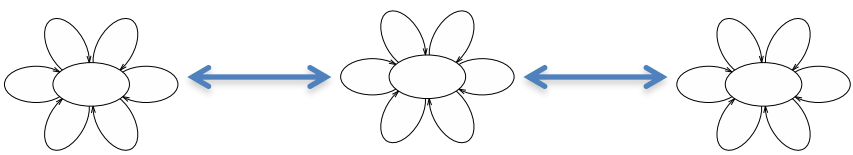

Fig 7. Several Patterns of Participation organised in a pattern of patterns.

Thus, by using the framework Patterns of Participation, the tales of the becoming teachers can be disentangled, illustrating elements of teacher education and other relevant practices. However, more importantly, it allows us to see how these social practices and figured worlds are related and patterned at a specific place and time. The uniqueness of every pattern can then be used to view shifts in participation during the longitudinal study. Patterns of

Participation links several patterns of participation in a pattern of patterns (Skott, 2013). By focusing on the relation of patterns, it was possible to observe the identity development processes of Evie and Lisa, as illustrated in the Results section (see "Results: The tales of Evie and Lisa", p.101). The illustrated shifts in their patterns of participation relates to their identity development as prospective teachers, who, in the future, will teach mathematics.

From structured information to generated data material

The Patterns of Participation framework is used as a focal lens to generate data material that illustrates shifts in prospective teachers' tales of themselves. The generated data material are outcomes from the use of the methodological tool. Examples of such outcomes can be a recurrent theme, such as a broken lexical chain, shifts in validity, or shifts in the use of personal pronouns.

During the process of generating data material, different phases emerged in each prospective teachers' identity development. Evie's development during this study can be described in four different phases, while Lisa's development can be described in three phases. What emerged and what constitutes these phases are presented in the chapter "Results: The tales of Evie and Lisa".

Through the structuring of the information, it is clear that the prospective teachers' contribution to and interpretation of immediate emerging social interaction can be linked in a fine-grained manner to their "prior engagement in a range of other social practices". It is also clear that the fine-grained analysis highlights small but essential parts concerning the aim of the study. Patterns of Participation can be used to search for relevant practices and can also be used to explain and problematise the way the re-engagement is conveyed and connected. By analysing the text with elements of Halliday's SFL, functions of language are highlighted that enable the use of the Patterns of Participation conceptual framework when presenting the results in the Results section, "Results: The tales of Evie and Lisa" on page 100.

Writing the Results section systematically

Here, writing ethnographically means presenting the results of this study in a way that illustrates the emerging process of becoming an upper primary teacher who will teach mathematics, among other subjects. The first step in writing the results was to generate data material by selecting parts of the structured information related to Evie's and Lisa's identity processes. All these selected

parts were entered into a Word document in chronological order. For example, the transcript below refers to Evie's personal experience of mathematics.

Fig 8. Structured data.

The second step concerned the process of analysing the discursive patterns, made visible by the methodological tool in the prospective teachers' participation. In this part of the process, the generated data material was transferred into the model by Skott (see page 63), which providing the possibility of a schematic illustration. These figures were also incorporated into the Word document.

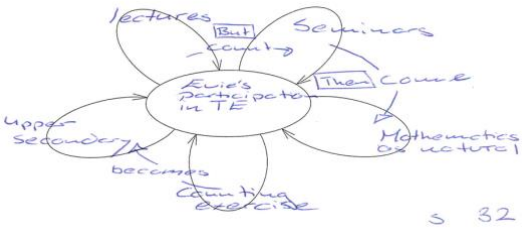

Fig 9. Re-engagement in mathematics teacher education during this interview.

The schematic figures also became a tool for comparing and contrasting different patterns in their participation. Figures related to each other were marked in the document so it would be possible to connect similar patterns over an extended period – the so-called patterns of patterns. Two examples are illustrated below, showing how the figures are connected and that their relation to each other was marked in the initial phase of writing up the results.

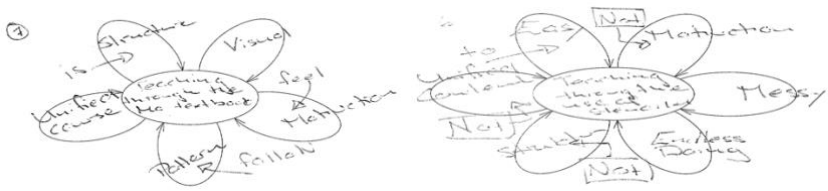

Fig 10. An example of contrasting/comparing figures.

In the first figure, Lisa talks about her positive experience from upper primary school and how the mathematics textbook contributed to her interest in mathematics, which remains to this day. As a discursive counter-image illustrated in the second figure, Lisa re-engages in lower primary school and describes what she perceived as not good teaching of mathematics. As described later, Lisa used similar notions and entities to describe these two social practices but with one significant difference – when relating her past participation to the lower primary school, a negative polarity can be identified by the methodological tool.

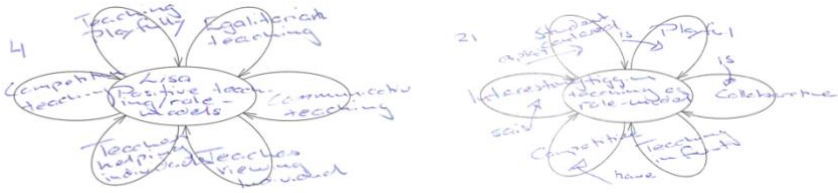

Fig 11. An example of moulding/fusing figures.

In this example, we can interpret how Lisa's role models differ or are similar. We can also, in some sense, view that the teachers from her past and her internship supervisor are used in the same way. Her experience is moulded together with her present experience. A more complex description of how she relates to these role models is described in the Results section.

The Results chapter was then written during an extended period, systematically in each step to produce the tales presented later. These tales are not just simple summaries of information, but rather they are the result of the aforementioned

analytical process. The intention was to write tales that let us experience how prospective teachers' interpretations of and contributions to immediate social interaction relate dynamically to prior engagement in a range of practices. This is in order to contribute with insights about how, or even if, experience from teacher education and other relevant past and present social practices and figured worlds matter for prospective generalist teachers' imaginings of themselves as primary mathematics teachers-to-be.

Concerning the conceptual framework, the tales produced emphasise what Clough (2002) refers to as demonstration rather than argumentation. The focus when writing the results is, therefore, to embrace the quest of narratively described lived human experience in relation to an explicit educational phenomenon by demonstrating it.

The results as demonstrating

As the theoretical discussion highlights, we present ourselves in a specific way in a given situation (Halliday & Hasan, 1989), and we position meaning as something that we engage in when interacting in the immediate social situation. As humans, we respond to situations by interacting with others and with the self, and by taking on the role of others (Holland et al., 1998; Skott, 2013). When this is done, discursive patterns unfold in the situation.

The researcher, however, narratively exemplifies prospective teacher's tales. The main reason for narratively illustrating prospective teachers is to try to understand and present to the reader of the thesis a perspective of human lived experience (Kaasila, 2007b). To present the results narratively is a method of recapitulating experience by matching sequences of verbal language to the sequence of events in which they occurred (Gee, 2005) and by highlighting patterns. The generated data are thus synthesised and shaped into two case studies of mathematics teacher identity development.

In the Results section, the tales are presented in chronological order through the different phases that emerged during the generation of data material. The patterns used are selected as significant linguistic choices or topics in the specific phases. Of course, they are eventually selected by me as a researcher when generating data material, but in the beginning, most of them were marked in relation to their intertextual relations, for example, lexical chains as broken or recurrent themes.

The intention with the narrative illustrations in the cases is to share Evie and Lisa's experience, so that the reader can understand what it is like to be a prospective teacher with high priorities in mathematics. According to Palmér (2018), cases can be an effective way to capture a persons' perspective and illustrate complexities.

Quality aspects of the research process

Many considerations have been made during the process of writing this thesis, and many relate to ethical issues. Accounts concerning ethical issues are about finding a balance between different interests when conducting research (Hermerén & Vetenskapsrådet, 2011). Ethics is intertwined in every aspect of a study (Alderson & Morrow, 2011); therefore, openness and transparency related to ethical issues are regarded as quality aspects of a thesis. The following quality aspects are highlighted in this section: reflexivity, external ethical engagement, being an insider in ethnographic research, and anonymity. Other quality aspects, like internal logic and trustworthiness – "writing up the result" have already been discussed in the theory and methodology sections.

The ethical issues can be divided into two parts: research ethics, later termed 'external ethical engagement', and the ethics and morals of the researcher, later termed 'internal ethical engagement' (Floyd & Arthur, 2012; Trowler, 2011). Floyd and Arthur (2012), Trowler (2011), and Hermerén and *Vetenskapsrådet* (2011) highlight that external ethical engagement concerns the more technical orientations discussed by, for example, *Vetenskapsrådet* (1990) as demands for information, agreement, confidentiality and the requirements in using the created empirical material. According to Trowler (2011), these technical aspects are easy to recognise, while the internal ethical engagement demands in-depth ethical considerations because of their moral dilemmas.

While external ethical engagement raises questions from the outside, for example, regarding the design of the study, the moral of the researcher poses questions from the inside (Floyd & Arthur, 2012). The moral is therefore related to the practice of conducting research (Hermerén & Vetenskapsrådet, 2011). Every research project influences the participants, prospective teachers and researchers in some aspect, sometimes directly and sometimes indirectly (Floyd & Arthur, 2012). There is no unique guide for how the morals of the researcher apply because every project and researcher is unique. Nevertheless, the majority

of this section is dedicated to addressing internal ethical engagement in some way.

Reflexivity

Ethnographic studies such as this study concerning education have ethical dilemmas (Dennis, 2010). As Aspers (2011) points out, conducting ethnographic research is an ethical challenge. This is mainly because the researcher gets to know the participants when exploring their everyday life in a long-term engagement (Dennis, 2010; Hammersley, 2006). This means that the researcher becomes central in the participants' lives, and therefore, ethical considerations must be continuously considered throughout the research process. Therefore, to be aware of and reflect on how one participates during the research process is highly important when discussing ethical issues. This reflected and articulated awareness is generally called *reflexivity* (Dennis, 2010).

However, reflexivity is more than simply an activity that contains self-reflection. An example of this is when planning a formal interview. This planning process involves considerations related to the aim of the study, the topics of the previous interview, and observed experience from social practices. Watson (1987) and Foley (2002) critique research that is solely connecting to this view because reflexivity then becomes an individual activity with few social elements. Foley (2002) refers to this reflection as a flow and an illusion because it is an illusory outside view from the researcher's perspective. Every researcher should recognise that they need to take reflexivity into account at all times, which means that reflexivity also has a situational aspect (Foley, 2002).

The situational aspect requires that the researcher be reflexive throughout the research process, and thus, recognise that he or she is a central part of the situation. This means that the researcher does not describe the research from an outside perspective but rather from within (Foley, 2002). Based on this, I must recognise that I, as a researcher, and the prospective teachers are parts of the shared dialogue. Moreover, I must consider the power relations involved in the process of conducting research (Christensen, 2004).

Another vital part of the shared social dialogue is the researcher's pre-understanding about the research topic and how this is shared with the prospective teachers. When conducting ethnographic research, the researcher

continually shares notions between social practices with the participants and vice versa.

When sharing a social dialogue with the prospective teachers during a long-term ethnographic study, the researcher and prospective teachers will close the gap between their ideational, interpersonal, and textual meanings. In Halliday's (Halliday & Hasan, 1989) terms, the research project develops its language. For this study, this means that a shared understanding and relationship (Christensen, 2004) is established during the study and that the prospective teachers understand the questions in a more nuanced way at the end of the project. Dennis (2010), Foley (2002) and Watson (1987) emphasise that one needs to describe this dualistic relation explicitly within an ethnographic thesis. However, this detailed description sometimes leads to the problem of the reflexivity blurring the empirical side of the research.

External ethical engagement

This study requires methods and theories that capture and problematise prospective teachers' lived experiences in the moment when they appear in social practice (Prus, 1996). Ethics concerns the advantages and disadvantages of each method concerning the participants and how useful the methods are in relation to the aim of the study (Alderson & Morrow, 2011). Together, the different methods should capture the complexity of "human" lived experience that allow interpretations through a theoretical or conceptual framework. Patterns of Participation is one such conceptual framework, as it sets out to describe the captured complexity by using a particular kind of language related to the aforementioned participatory perspective.

The coherence of the aim, method, theoretical aspects and the created empirical material is essential to ethics because they indicate values, or standpoints (Alderson & Morrow, 2011), which guide how the prospective teachers will be presented in the thesis (Hermerén & Vetenskapsrådet, 2011). Patterns of Participation focus on human lived experience and not on what lived experience the prospective teachers should have or should acquire during the teacher education. Using Patterns of Participation problematises prospective teachers' participation and does not judge or evaluate. This was important for the theoretical choice, as it was important to choose a perspective that focuses on and presents results related to prospective teachers' articulated imaginings of themselves (see previous discussion concerning demonstrating versus argumentation).

The research questions in this thesis are posed in relation to the identity development of prospective teachers to ensure that the focus of this thesis is in line with the prospective teachers' everyday lives as they attend teacher education. This is in order to close the gap between the aim of the study and the prospective teachers' daily social practice and interest. According to Christensen (2004), the gap is seldom closed. This is problematic. If the aim does not resonate with the lived experience of the participants in an ethnographic study, there will be problems gathering valuable information.

As mentioned, this research project influences the prospective teachers in some ways (Floyd & Arthur, 2012). Therefore, the researcher must consider the risk for the participants to be harmed or offended (Hermerén & Vetenskapsrådet, 2011). Harm in social research is mainly related what has been written and published (Alderson & Morrow, 2011). Therefore, in this case, it was important for the prospective teachers to be given accurate information about the research project and its intentions before consenting to participate (Alderson & Morrow, 2011; Vetenskapsrådet, 1990).

Insider in ethnographic research

Internal ethical engagement concerns the ethics of the researcher, and all ethnographic research involves these dilemmas. When researching within one's institution, as I have done, these dilemmas become relevant because you as a researcher are both professional as a researcher, and in some cases, also have personal/informal relationships within the institution where your research is conducted (Floyd & Arthur, 2012; Trowler, 2011). As an insider, you naturally take on multiple roles.

This research project researches teacher education partly within my institution and can therefore be termed as interpretive insider research. In this sense, it is important to consider the borderline between being a researcher and colleague. Troman, Jeffrey, and Walford (2004) highlight the tension between the different roles that the researcher may have. This was evident when I wanted to gain access to lectures and seminars conducted by my colleagues. However, after a discussion about the intentions of the study, all teacher educators gave their consent. I was aware of the circumstance that consent may have been given for several different reasons, for example, that my colleagues may have felt that the nature of the created empirical material was not of a very personal nature or that the study focused more on the prospective teachers and not the teacher educators. I also reflected on the possibility that my co-workers may have felt

obliged to give consent to me, a colleague. On the other hand, my colleagues were aware that the prospective teachers might speak about them in interviews concerning lectures and seminars in any case.

To be an experienced insider embedded in a social practice with others and thus potentially emotionally involved in the research phenomenon can be problematic, as discussed, but it may also be beneficial (Alderson & Morrow, 2011; Floyd & Arthur, 2012). Walford (2008) and Aspers (2011) emphasise that it is an advantage to know the situation that you engage in, and based on that, one is able to make sensible choices. As an insider, you are already acquainted with the social practice, and thus, access might be easier to gain. Also, the researcher can obtain material and information that otherwise would be impossible. In Asper's (2011) point of view, my experiences of being a prospective teacher as well as a teacher educator certainly gave me the advantage of an insider, helping me notice things that an outsider would not see. Of course, there is in some sense, also the risk that an experienced insider takes things for granted and that this may potentially blur the research process.

I would argue that I have a high level of insiderness. As a teacher educator who is also a doctoral student, I am embedded in the setting that is shared with the prospective teachers. Normally, I would have taught some parts of the lectures that I have attended with the prospective teachers. This means that I am not only embedded in a shared setting but also emotionally engaged in teacher education in general because I am also responsible for it. However, the prospective teachers in this thesis are, as described earlier, a part of the new teacher education established in 2011, in which I have not been teaching during my work with this thesis.

Anonymity

Institutional anonymity is problematic for an insider researcher, and perhaps even meaningless, according to Floyd and Arthur (2012). The researcher must acknowledge that their workplace is known and consider this when planning the study. This means that, in my study, I should focus on the anonymity of the prospective teachers and the teacher educators.

A problem that needs to be taken into consideration is the anonymity of colleagues teaching the participants in this study. The teacher educators and some of my other colleagues may recognise themselves. From this perspective, the focus is to try to make the teacher educators anonymous in an external way,

so that they are not recognised outside the institution. The anonymity of the teacher educators is more problematic than the anonymity of the prospective teachers. For example, on the website, you can find the names of employees and even topics of interest. Teacher educators are also more likely to read research literature than, for example, prospective teachers who have become teachers.

Regarding the anonymity of the prospective teachers, total anonymity was not possible.

> Existing approaches to achieve this [anonymity], such as changing participants' details (gender, age, background), are, by their nature, problematic for interpretive researchers, since these aspects are often crucial to an understanding of a research participant's perspective. (Floyd & Arthur, 2012, p. 7)

Even though the prospective teachers' names have been changed, they will undoubtedly recognise themselves, and there may be some fellow prospective teachers that will identify the prospective teachers in this study. Therefore, total anonymity cannot be granted, although it is the optimal outcome.

Results: The tales of Evie and Lisa

This chapter presents the tale of Evie and the tale of Lisa as case stories about their processes of becoming teachers. As pointed out, tales require another kind of reading than a traditional scientific research text. It requires a so-called aesthetic interpretation. A tale is considered an aesthetic description that offers scenes and situations that we almost can feel within ourselves (Rosenblatt, 2002). It is a virtual reality for the reader to explore (Flyvbjerg, 2006) that provides the reader with situated aspects (Bjurland et al., 2012; Hodgen, 2011) about Evie's and Lisa's processes of becoming primary generalist teachers. As Flyvbjerg (2006) indicates, case stories can neither be briefly recounted nor summarised in a few main results: "The payback [for exploring an in-depth case] is meant to be a sensitivity to the issues at hand that cannot be obtained from theory" (Flyvbjerg, 2006, p. 239).

The following tales intend to provide in-depth descriptions about the prospective teachers' processes as close to their points of view as possible. The created empirical material is structured, and the highlighted aspects of the tales derive from the structuring itself. These aspects then become the critical moment within the tales and influence the structure that is used to write each tale.

The Theory chapter and the Methodology chapter strive to justify the selection of components that are in line with the intentions of this study – that the tales are intended to be written to reflect human lived experience. Therefore, I embrace the quest of presenting the accomplishment of inter-subjectivity, how Evie and Lisa become social entities, how they attend to others and how they align with the pursuit in which they participate in day-to-day life while attending teacher education.

The conceptual framework of Patterns of Participation and the idea of engagement and re-engagement as inter-textually stratified experience is used in this chapter to produce these tales in a way to illustrate shifts in prospective teachers' tales. These shifts within the tales are related to Evie's and Lisa's identity development, with identity as a stratified inter-textual re-negotiation and justification. Each tale, as it emerged during the analysis, is presented in a chronological order structured through phases to highlight social practices and central elements of figured worlds in Evie's and Lisa's participation.

The tale of Evie

Evie's identity development is described in four different phases. These phases became affiliated with her degree of certainty, modality, and they connect with specific social practices, events and central elements of figured worlds in her teacher education experience. As will be illustrated, these social practices, figured worlds and activities made Evie's discursive patterns change during her teacher education experience.

In the first phase, Evie re-engages in past school-related experience with a high degree of certainty. She takes the view of a former student in those classrooms while talking about teaching and learning mathematics. In the second phase, Evie starts to contrast her past participation involving students in her imagined future class with herself teaching. As will be illustrated, the later experience of actual teaching at the internship (VFU, see Fig. 12) has consequences in her tales of teaching mathematics. She becomes insecure, showing a low degree of certainty concerning teaching mathematics. In the third phase that correlates with the mathematics course in the teacher education programme, Evie becomes an active participant concerning the subject of mathematics itself. Being a part of the mathematics education course contributes positively to her tales of herself as a teacher-to-be. However, at this point, she still participates peripherally in the mathematics education classroom despite feeling comfortable with the subject of mathematics. In the last phase, she becomes a central participant in the mathematics classroom. She transforms into a "real" teacher, with a high degree of certainty, from her point of view, which is possible to detect in the way she talks about herself and in the way she acts. The tale of Evie can therefore also be understood through the identity indicator described by Bjuland et al. (2012) as a shift in language. In this case, how she loses and then gains confidence.

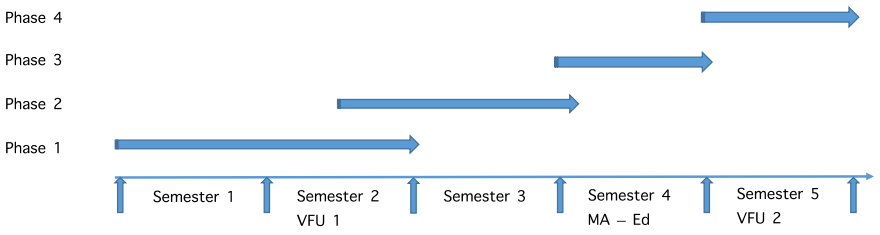

Fig 12. A timeline visualising the different phases of Evie's identity development.

Phase 1: Evie's mathematical background provides confidence

In the very first interview (2011–09–02), Evie describes how, from an early age, she developed a passion for mathematics as a subject. While recalling her participation in past school-related activities, she credits this passion to the fact that she found mathematics easy. In the interview, she re-engages in previous primary school classrooms, recalling a quiet atmosphere where having the most pages completed in the mathematics textbook was the primary goal of each student.

She signifies these past social practices with participation that concerns "competitions about who had come the furthest". Evie perceives this way of participating as something very positive because she was one of the "fastest in the class" during primary school. However, when Evie problematises and re-negotiates her past participation during this interview (that included questions about her past participation in several different mathematics classrooms) before the start of her teacher education programme, she concludes, "in retrospective, it was quite negative". At the end of the interview, she positions herself differently in relation to her prior school-related experience.

Evie had already started critically re-negotiating the way the mathematics textbook guided her participation in past social practices before entering her teacher education programme. However, even though she is critical about some aspects of her prior involvement in the primary mathematics classroom, it is

clear in the first interview that her first experience of school mathematics has contributed to her positive mathematical identity that has evolved over the years.

From the beginning of this study, it has been clear that Evie has been influenced by someone concerning being a teacher and teaching mathematics. As mentioned, she has already started to re-negotiate parts of her past school-related experience by contrasting the past with a social practice yet unknown to me. As it turns out, Evie's mother, Angela, has graduated relatively recently as a primary mathematics teacher, and she began working as a teacher in 2005.

Through conversations with her mother, Evie is ready to start problematising mathematics teaching from the very beginning, before entering her teacher education programme. She recognises herself as a student in past classrooms and poses questions that directly relate to her future profession, such as, "How do you know [what level] where to begin?". Even though Evie has had positive experiences with mathematics throughout her primary and secondary school years, she now, in retrospect, concludes that "at upper secondary, all students worked with the same content, so to say… you worked in the same chapter… at upper primary, it was like… work as much as you can…it did not matter if you were two mathematical textbooks ahead". She is critical about her primary school experience and how the work within the mathematics classroom was conducted as an individual endeavour where the common goal was to get as far as possible in the mathematics textbook. In relation to this, "you as a teacher should at least have your students working with the same content", Evie concludes.

Evie recalls that the teachers at upper secondary school had an interest in the material process of students doing, and "if there was one task that many found hard to manage… they highlighted the task on the whiteboard so that the whole group could participate". Evie contrasts her participation in the primary mathematics classroom against her positive involvement in the upper secondary school classroom. These two social practices become discursive counterparts that Evie uses to constitute the teacher, the teacher's way of acting, and how one could value good teaching. In the first interview, the teachers that Evie recalls from upper secondary school become models of good teaching.

As an upper secondary student, Evie perceived herself as academically successful in mathematics. She re-engages in these past experiences and re-negotiates the image of teaching mathematics that includes both individual work

and group work. In this, Evie recognises a problem relevant to her future practice as a teacher in a classroom: How do you explain the same mathematical content to all students? Students are different. Through recalling her experience from upper secondary mathematics, Evie realises that this was solved in her primary school experience by letting all the students work at their own pace.

Through the functional analysis, one can interpret that Evie has chosen what is called 'a unified course' for her future teaching. A unified course is a structure where students work with the same mathematical content together at the same time. In her early years, Evie had participated in a mathematics classroom where every student worked at their own pace through the mathematics textbook.

The analysis also shows that Evie uses a high degree of certainty when re-engaging in the specific choice of her entering teacher education: "I have always liked children and always been interested… I have always wanted to become a teacher". "To become" is a relational process between the "I" and the future identity of a teacher. When re-negotiating the choice of upper primary as a specific focus, she answers that children in upper primary are neither too young nor too old and tough.

Evie's tale of herself as confident during this stage of her education relates much to her general prior experience of school and mathematics, specifically of attending her upper secondary school and participating with her mother. Her confidence is evident in her high degree of certainty when discussing her past participation as a student.

She also emphasises that "they [media and politicians] talk about the good teacher… it is…it is this with having the right knowledge and being able to explain to create deep understanding". This was said in relation to what she considers a public and political assumption about prospective teachers. She also expresses that she has the right mathematics experience that is needed. The teachers who are recognised in this public-figured world can act in a specific way because they have the values taken as shared concerning being good at mathematics.

However, as evident in her earlier questions relating to the teaching of the subject itself within her future classroom, her degree of certainty becomes lessened. There is a tension between the expressed confidence based on her past participation as a student in school and her somewhat cautious way of imagining her future participation as a teacher in a classroom teaching mathematics. Of

course, this may be natural because she is to begin her teacher education experience.

Teaching for deep understanding

In this phase, being able to develop a deep understanding of mathematics concerns mainly two things: first, being able to explain mathematics to others and then having a connection to mathematics as it plays a role in the society. Evie re-engages several times in a justification about mathematics as connected with the world outside the classroom and merges the worlds outside and inside the classroom. They are interrelated: "That you put it into the context of the soc ... in the society ... that everything is connected with money, prices, rates and stuff [...] Without mathematics, we are not able to keep track of money, rates and stuff on the bank".

The ideational metaphor "put it into" means that, when teaching, one needs to relate mathematics to things outside the educational sphere. This interrelated connection is the foundation, according to Evie, for developing what she terms 'deep understanding'. Deep understanding is also related to the fact that everything in mathematics is related to each other: "That mathematics is not just to sit and work addition and subtraction ... everything is connected". However, the material process "sit" that relates to an act of doing addition and subtraction is, in Evie's view, the most fundamental skill. A skill that students need before entering society: "You have to teach them addition and subtraction; otherwise, they [students] do not get it".

During the first phase when Evie relates to her future teaching, she is in many ways a student in those imagined classrooms. At the same time, she expresses ideas of herself as a teacher and presents a clear image of her future teaching already from the very beginning, in light of her former teachers' teaching. She moulds together her mother's teaching with her upper secondary experience during the first interview. She tries to balance her future teaching and the expectations of teaching that she thinks is promoted by politicians, media and people in general.

Evie re-engages in these expectations and mentions that "they", or the general opinion in society, promote a view of the classroom as a place where it "should be quiet and each student works quietly with their things". However, when re-negotiating her future teaching with the expectations of the general society, Evie uses the adversative conjunction "but" to position her participation in another

direction. Evie views the participation in her future mathematics classroom to have "some activity and movement so that they can explain to each other, help each other ... the most important thing is not that they are quiet and that they sit still one by one [as promoted by politicians] ... it is this thing with explaining and to get a deeper understanding". Evie concludes that she developed a deep understanding of mathematics through her participation in the upper secondary classroom. She wants her future students to establish this kind of deep understanding.

Establishing deep understanding is essential for Evie because it relates to the verbal process of explaining. To be able to explain means that the classroom cannot be quiet, because in quiet classrooms children cannot help each other. Thus, she rejects the way of acting as teachers and students that is taken as shared by "them". In Evie's opinion, what should be valued instead is students helping others. Evie expresses the idea that students who are ahead of others mathematically, should help others. When interviewing Evie, it is quite clear that she herself probably was a student ahead of the others and also one of the helpers in her own previous classroom.

In her discursive patterns, Evie uses different experiences as inter-textual building blocks to create an argumentation and justification for her future teaching. Notable for her identity is the position she takes against her primary school experience and the promoted mathematics teaching of the politicians, media, and people in general, and she draws on this in her argumentation about her future teaching. The point is that she uses her family, past school experiences and public expectations about teaching mathematics when engaging in her imagined mathematics classroom.

Being different from others

Evie is distinctly different from the other prospective teachers at the beginning of this study. She is the only one who discursively legitimises her discursive patterns in relation to social practices other than her schooling. While the others only emphasise past good or bad teaching experienced as students themselves, Evie contrasts her experience with the expectations of "they", which may include society's political agenda regarding good teaching. In this way, Evie has another starting point than the others when entering teacher education.

She had already started to use ideational metaphors related to teaching and learning before entering teacher education. From the very beginning, even

before her teacher education experience, Evie has participated in a somewhat shared educational language using subject-specific ideational metaphors. She talks about teachers "doing" with no further explanation. Evie may take these metaphors for granted by not explaining them in interviews and much later (for example, in lectures during the mathematics education course), which indicates that, in her participation, Evie uses, like me and others, a language repertoire used by real teachers.

Evie, for example, re-engages in Angela's teaching and mentions how she promotes the need for mathematics in the future: "She says that many students ask questions about if this is reasonable… she has made that clear to them." This clause contains, for example, a material process "she has made" that is regarded as such a metaphor. When Evie points out that "she has made that clear to them", she summarises a long-term process that indicates her mother's action in the classroom. In this situation, the teacher is teaching and the students are listening and learning.

When Evie uses this type of language repertoire, her mother is always a participant in the background: "We talk a lot about school at home because my mother is a teacher", "We think mathematics education is great", "We have discussed [the topics in my interview] many times before at home", and "I want to say that I have been properly informed of how it is to be a teacher because both my mom and my aunt are teachers. I know what I engage in."

Evie justifies this discussion by saying that "I come from a mathematics family and everybody is interested in mathematics […] we sometimes talk [about educational things], but at the same time, you want to change your own experience". The conjunction "but" and the relational process, "change" indicate a tension between, firstly, Evie's past participation in school-related activities and her involvement with her family, and secondly, her future teaching of mathematics. Evie indicates the possibility that her previous participation in school-related activities can be re-negotiated and transformed in her future teaching. Concerning this, it was not a surprise that Evie had already started to re-negotiate her prior experience before entering teacher education. It is clear that Evie uses the "we" to position herself in relation to other prospective teachers of the teacher education programme she has now entered.

Evie interprets her mother's teaching as successful. Therefore, the social practice that Angela is a part of is used to justify Evie's negotiation of her future

teaching, which is the main point. Evie re-engages in other social practices than previous school-related experience. In this, Angela becomes a recurrent theme, a significant linguistic choice in almost every interview, lecture, seminar, study group and so on. Evie legitimises her participation through her mother, Angela.

When Angela is interviewed (2012–09–10), she is critical about her own teacher education programme from 2005, which, according to her, lacked any element of how to teach. Therefore, she considered it "a great opportunity" for Evie to get the quality education that she did not get herself. She regards the quality of the teacher education programme that Evie will attend as much higher than the teacher education programme that she herself attended. Angela says that "Evie's education is good for me too."

Emerging issues in this first phase

To summarise what comes out of the first phase of the study, it is possible to see how Evie's re-engagement in two specific social practices and two figured worlds clearly become important. The first social practice that she re-engages in and re-negotiates is past school-related experience, mostly from her upper secondary mathematics classroom. Evie was a skilled student in those classrooms, and she now uses that experience when she talks about herself as a prospective teacher and a future teacher. The other social practice is described thoroughly and relates in different ways to her mother Angela and her teaching.

The first figured world relates to "they", in which Evie relates to the public and political assumption referring to the educational system as a whole. This figured world can be interpreted as referring to "traditional teacher-centred classrooms" and a quiet working environment. On the one side, she recognised herself as having the knowledge the society wants because this figured world is populated by mathematically proficient prospective teachers and qualified teachers, who can all handle the subject of mathematics. Knowledge in mathematics is what is valued the most. However, she does not fully align with the picture of teaching that the society promotes. Evie also engages in another figurative classroom relating to a performative culture where she finally becomes recognised as a mathematically proficient student. She becomes recognised as a helper of those who do not know the mathematics. During this phase, Evie has a high degree of certainty while connecting these two social practices and these figured worlds.

Thus far, we have come to know how Evie identifies herself and her family with the subject of mathematics and that she, from the very beginning of this study, re-engages in subject-specific ideational metaphors. These metaphors indicate her participation in pedagogical discursive arenas where the language of mathematics education is used. In this way, Evie is clearly confident. However, even though Evie shows a high degree of certainty throughout this phase, I experience her as constrained and non-talkative in the beginning of the study.

Phase 2: Insecurity arises at the first internship

In the second phase, Evie mainly re-engages in four different specific topics related to this study and the teaching of mathematics. The first topic refers to the first phase that highlights "activity and movement" as a means for developing a deep understanding of mathematics. In some way, this associates with a general discussion about the arrangement of mathematics teaching. The second topic concerns her present experience of teaching mathematics at the internship. This experience affects Evie, and she elaborates her thoughts about actually teaching. For the first time, she mentions the students who will attend her future mathematics classroom. Thirdly, Evie's mother Angela is still a recurrent theme in her tales, but in this phase, the relation to her mother changes. Her mother becomes more of an educational advisor or support when Evie's degree of certainty in her tales decreases. The last topic draws on mathematics as a part of the society and the role other subjects have in the teaching and understanding of mathematics.

Much of the time, Evie re-engages in the same social practices and figured worlds as in the first phase. However, the way she re-engages, how she re-negotiates, is different. In this phase, she expresses a clear sense of insecurity. She tries to get confirmation from her mother and the students in the classroom where she teaches. Validation from the students seems to be significant.

Re-negotiating the social practice of teaching mathematics

When entering the second phase, Evie had been at the internship for two out of five consecutive weeks, attending teaching before my arrival. When talking about her future teaching, she describes it in general terms and just slightly draws on her new experience of teaching at the internship. Something that she does talk about, however, is activity and movement in relation to the quiet classroom.

In the previous section, retelling the first phase of the study, Evie emphasises that "there must be some activity and movement so that they can explain to each other, help each other", and in the second phase, she expresses how students' discursive acts are a means for testing thoughts. Evie is clear about the relation between the quiet and the discursive acts in the classroom, emphasising that "some might not cope with reading and therefore they need someone to explain why things are as they are and help them on the way". Here, Evie indicates that some students cannot learn mathematics by themselves, and therefore, a teacher or fellow student needs to help out by explaining.

Once again, she mentions the helper as an important actor in the mathematics classroom, but during the interview, in relation to teaching mathematics, she mentions that

> I think that students should be able to talk and help each other because they should be able to express their opinion and realise if there is someone else agreeing with them or if they are on the wrong track ... but then it is obvious that sometimes the class needs to be quiet. (2012–03–26)

At this stage, there is a shift in Evie's discursive pattern in relation to the first interview. The adversative conjunction "but" is not used in this phase to exclude the quiet classroom as a social norm from the society as it was in the first phase. It is now used to include the quiet classroom as a complement – a necessary element in the classroom dynamic. One can interpret this shift as a consequence of her new experience of teaching that will be explained later.

Her first teaching experience and its consequences

The significant shift in Evie's participation in this phase is related to students' involvement in her present and future classroom. If the previous phase aligned more with her view as a former student concerning the arrangement of the classroom as such, the discussion now includes students who are actually teaching and position herself as a teacher. This shift in identity reveals how she starts to re-negotiate her teaching as a prospective teacher teaching mathematics within the classroom, and it has consequences for Evie.

When Evie re-engages in her internship experience, she directly starts to integrate students into the conversation. The degree of certainty in Evie's tales becomes low in all these sentences that include or relate to students. One has to remember that she, until this point, has had high modality in most of her tale.

> One could maybe test new things and let the students evaluate it, and contrast […] find what suits me and the class best […] Hopefully, you have the students with you and that they think the same … that they think that it is a good method. (2012–03–26)

The low modality in the interview from 2012–03–26 indicates that Evie's level of certainty has become low. This low level of certainty is a recurrent theme throughout this phase, but only when engaging in conversations that refer to students. For example, later in this phase, she emphasises in an interview that "You can check out a little what the students are interested in so that you don't start working with something that no one is interested in" (2012–12–04). In the first phase, Evie uses many utterances like "the most important thing" concerning her future teaching, while in this phase, she says, "I would probably" instead. Although the content is similar, the modality is high in the first phase and low in this second phase.

It is clear that, for the first time, the students have become central participants in relation to Evie's utterances, where she alternates between pronouns such as "one", "me" and "they". The use of "me" indicates that this is about Evie as a prospective teacher. The transivity system and the personal pronoun "they" indicate that the students' attitudes towards Evie as a teacher have become most important. Evie seems to want to align with students so that they like her as a teacher. This may also indicate something about how she experiences the relationship with the class that she teaches at the internship.

Evie's use of "think" and "interested in" in relation to students points to a theme that is recurrent in this phase. In the first interview, she describes a view of her imagined practice in relation to her prior experience as a student attending school. Now, she describes her future imagined teaching as a prospective teacher who has experience of teaching. The perspective she takes – that of the former student or the prospective teacher teaching – influences how she describes the specific social interaction and the common endeavour.

Evie teaching at the first internship

Before entering the classroom at Evie's first internship, we need to understand how Evie participates in the first phase. At the beginning of the study, as indicated previously, she is very constrained and non-talkative. However, even though I perceive her as non-talkative during the first phase, she was secure with the content of the first interview, proving to reason in a mature way despite just having started her teacher education.

The following are some small excepts of the field notes taken during a mathematics lesson a few days before the interview at the first internship.

> Field notes: XXX [the internship supervisor] is coaching Evie and gives her advice about being distinct and to dare to speak out. – "Remind them also to take notes!" […] Evie positions herself on the side of the room. She stands with her arms crossed looking down to the floor all the time. She does not look once at the students to see what they are doing. She seems very uncomfortable […] Half of the students in the class raise their hands, some speak out loud and are clear about what they want to say […] There are many comments [from other students] in relation to things that different students say. During this period, Evie ignores those talking loudly and listens to those holding up hands (2012–03–27).

Evie completes this lesson without the involvement of many students. One could see that she is struggling and ignoring the noise in the classroom. At one point, it seems like she is crying.

During the interview and based on the field notes from this internship week, Evie has only good things to say about her internship experience and the mathematics internship supervisors. However, that changes during her education, especially during the second internship when she talks about her prior experience. She then clearly states that she was not satisfied with the first internship.

I interpret this as Evie struggling during her first internship, when she experienced teaching as highly problematic and that her teaching did not work out as intended. In relation to her past experience from her own years as a student, the way these students act is very different. I interpret that the experience from Evie's distinct different social practices, her own prior classrooms, and the mathematics classroom at the internship contributed to the pattern of insecurity she shows in this phase.

Angela becomes important

Angela's role now changes in relation to this first internship. Evie is still re-engaging in Angela's teaching, but she mentions Angela more often in terms of an educational advisor that helps her in many ways. However, Angela becomes even more than an educational advisor – she provides Evie with vital moral

support. Angela is an important role model who gives Evie a sense of security when striving as a prospective teacher at teacher education. Evie fully aligns with her mother's suggestions, relying on her judgement as someone with first-hand experience. She admits that "many of my thoughts and ideas I have got from her, her opinions and so, I also feel that we probably are quite alike as persons too […] my mom is into the new way of teaching and talks about students in difficulties and not students with difficulties". Evie is promoting her mother at this stage as a teacher who knows the pedagogical language well, and therefore, she too knows how to use the "correct" terminology for an actual pedagogical discussion.

As indicated in the first phase, Evie promotes her mother's teaching but suggests that, in the future, she will need to do things in her own way. This sense of independence, "but at the same time you want to change your own experience", cannot be found in this second phase. It is noteworthy, but not surprising, that Evie's mother Angela becomes a stronger educational influence during this phase, while Evie's confidence as a teacher-to-be seems to decrease. My interpretation is that Evie, now more than ever, needs educational and moral support. Angela provides Evie with that support. The importance of Angela is changing, when she as a role model merges or is constructed into an authority figure that Evie trusts to have the right interpretation regarding teacher education. Previously, she has been an inspiration for Evie, but now she is more of a lifeline for her when trying to survive her first internship experience. In the first phase, Evie relies on her own strength as an accomplished mathematician, but now she realises this experience is not enough to function as a teacher.

In the first phase, Evie engages in several different social practices and elements of different figured worlds. However, in the second phase, Evie does not bring in any other figured worlds or social practices other than her mother's teaching. She is clearly using few discursive counterparts in her argumentation and justification. This goes against how we usually tend to rely on several different aspects of our network of social practices. Evie seems to do the opposite, to draw back from her prior experience, showing insecurity in relation to its importance. Evie does not use any discursive counterpart other than her mother, not even the internship experience that she currently attends, to legitimise her argumentation and justification. Angela is now the main contributor to Evie's educational work and planning of how to conduct her education.

This means that Evie uses fewer social practices and figured worlds as inter-textual building blocks in her discursive patterns in phase two than in phase one,

which breaks the norm of what should happen when being educated. Her pulling back is a strong signal of something important happening in her process. There is a strong reason to interpret her internship experience is the main contributor to this phenomenon, and in my study, it is clear that Evie is in need of the advice and support Angela can provide.

Angela as an important guide through times of hardship

An example of how Angela supports Evie in her educational work is when she concludes, according to Evie, that if Evie wants to become a "classic class teacher", she needs both the subject of natural science and the subject of social science within her teacher education exam. Teacher education restricts Evie in one way. Each prospective teacher is supposed to have only one additional subject other than Swedish, English and Mathematics. Evie has chosen to take the course in natural science within her teacher education, and therefore, social science needs to be studied outside her teacher education programme, in order for her to follow Angela's advice.

Later in this study, it becomes clear that Evie's mother Angela herself took this social science course at another university the year before Evie, and she now recommends Evie to do the same. However, the course in social science that Angela took was an in-service course for practising teachers, which means that the participants had experience with teaching and that the assignments were designed in relation to that expected experience. However, Evie does not have this expected experience or a classroom to complete all the assignments in the course, and therefore, she needs a school-related practice where she can carry out the assignments. Once again, Angela manages to provide the support Evie needs to take on the extra demands of the additional course.

Evie involves her mother as a resource for managing her studies in social science and closely follows Angela's educational advice. She is clear when describing how she uses her mother in relation to the teacher education and in-service course context. From the interview 2012–12–04:

Researcher: How much do you (Evie and her mother) discuss your schoolwork?

Evie: We do not discuss my schoolwork, but I send her my assignments and ask if they are okay.

Researcher: Do you disagree with her sometimes?

Evie: No, I agree with the criticism and change.

Researcher: So, you are sending your assignments to her for a response?

Evie: Yes, especially during the history course. Sometimes I feel that my thoughts are not ready. I need input on what I might have forgotten.

Evie and Angela participate in a pattern of silent communication which is seen in the material process "send" and the mental processes "agree". When Evie relies on these processes, it concerns her mother's authority as a legitimate participant within a general teacher community. The negative polarity "not", the adverb "no" and the lack of relational processes in this phase indicate that the participation is directed in one direction, from Angela to Evie. The strong "we" in the first phase is not entirely clear anymore.

Angela is not only a tactical educational advisor or a critical reader. She also provides Evie with classroom material to use in her coursework. Evie "thinks it is a good course (social science) […] then it is the methodology (how to teach) and local pedagogical planning, LPP … but I have the advantage of getting the template for the LPP from my mother that they use in Angela's school (2012–12–04)." When turning to her mother to get material that she can use for her course assignments, Evie forms a specific social interaction with Angela. Their common endeavour is to manage Evie's education.

Elaborating future teaching

In the second phase, there is an aspect that needs to be recognised that can be traced back to the first interview when Evie indicates that mathematics is "not just to sit and work". In phase two, she expresses that mathematics as a school subject is more than learning by engaging in a mathematics textbook and working page after page. Evie mentions that mathematics is "a part of society and a basic knowledge so that one can cope with the world ... above all ... when you go shopping and when something is needed in everyday life ... not just something that one should do [in school]". Evie re-engages in and uses experience from mathematics classrooms and the discussions from home when having this conversation. By considering the linguistic relation of how she uses words like "cope" and "needed", Evie stresses how important mathematics is for the individual. In the last sentence, the material process "do" is also considered as an ideational metaphor. This metaphor indicates that mathematics is more than the activity itself – there is something more to doing mathematics.

As the second phase unfolds, Evie becomes increasingly more nuanced about the relation between mathematics and her future teaching. She elaborates on her initial understanding of the subject as more than just completing the pages in the book. There is a critical moment when Evie expands her way of reasoning by bringing a new notion into the discussion. This happens at the end of the second phase. Just before entering the mathematics education course, Evie mentions that her thoughts of what mathematics is in a school setting are related to "reality-based learning". Reality-based learning is an ideational metaphor that means that mathematics is used in relation to everyday life as a means for learning mathematics in school.

Evie specifies that if one should be able to teach this everyday life mathematics, one needs to know "area, perimeter and arithmetic […] basic maths […] and how you could challenge the students that understand and are ahead so that they learn all the time." Here, she emphasises concerns about what to teach, but one can also see that the question from the first interview about the level of teaching is still prevalent in Evie's tales of teaching and learning mathematics: "It is not just to sit and work it is about connecting it to the society […] if you are at Tivoli [an amusement park in Denmark] and you should pay, and so you want to split it on everybody and so (2012–12–04)". Once again, Evie relates to a figurative classroom where a performative challenging culture is visible by bringing in those who are ahead of the others. Most important is that the mathematically proficient student also are able to learn. This can be done by bringing in 'reality-based learning'.

In the first phase, we learn that Evie highlights a combination of individual work and group activities in her mathematics classroom. Students will move around, explain and help each other. Her idea of teaching aims at creating a deep understanding of mathematics, something that Evie considers impossible to achieve through individual work alone. Later, during the second phase, Evie emphasises that:

> I would probably start off from a mathematics textbook but also from other settings and give other tasks ... not being so dependent on the book ... not do ten pages every week, but instead, give them a deeper understanding [...] subject integration ... involve other subjects to show that maths is more than working pages by page ... from top to bottom. (2012–12–04)

In this interview, Evie highlights the textbook as the primary source in her future teaching while also indicating that only using the textbook cannot give her prospective students deep understanding. One can conclude that her reasoning during the first and the second phases is almost identical regarding the entities and processes related to the mathematics textbook, but her new experience of other subjects has made her complement and expand the idea of her future teaching. Through courses in Natural and Social Science during the second phase, subject integration is introduced as a central theme that extends to the beginning of the mathematics education course. Teacher educators in other subjects relate their teaching to the subject of mathematics, which falls in line with Evie's thoughts about teaching and learning mathematics in relation to the society outside the mathematics classroom.

Emerging issues in this second phase

During the second phase, Evie participates in her first internship, and further on during her teacher education, she refers to herself as a prospective teacher with teaching experience. She no longer refers back to her own schooling as the primary linguistic choice in her discursive patterns. Through both interviews and observations, we can follow how teaching becomes problematic in her re-engagement in the internship experience.

This experience is marked by a significant shift in the function of language. The modality she uses becomes low. Also, the character of the support she needs from her mother changes. It is worth noting that, during an extended period, Evie does not re-engage in any figured worlds or social practices other than those represented by her mother. Angela and her teaching is the main contributor during the second phase, acting as Evie's "helper".

In this second phase, help and support can also be discussed in connection with how Evie talks about the teaching situation. The challenging teaching situations that Evie strives to create mirror a performative culture or Evie's personal performative priorities as they actually can be seen in how she and Angela perform together.

Phase 3: Gaining security by mastering the mathematics

The beginning of the third phase coincides with the beginning of the first course in mathematics education at the university. As pointed out in the Introduction, the mathematics education course is a 30 ECTS credits block divided into two 15 ECTS credits courses: Mathematics, and Mathematics Education I and II.

These two 15 ECTS credit courses are then divided into four 7.5 ECTS credits courses that the prospective teachers attend during their teacher education. In this section, these four 7.5 ECTS credits courses are referred to as subcourses one to four. Subcourses one and two relate more to prospective teachers' own mathematics than the last two subcourses that relate to different pedagogical perspectives.

In the beginning of subcourse one, there are many emotions involved. Some of the prospective teachers cry out of fear because they feel very anxious about a subject they have prior negative experiences with and are convinced they cannot handle. Others cry out of relief because they, for the first time, feel that they finally understand a mathematical phenomenon or because the teacher educators promote another type of teaching than the one they experienced in such negative way earlier in life. There are also feelings of indifference expressed by some prospective teachers who do not engage at all during the first and seconded subcourses. They feel that the courses set low expectations. From their point of view, they already have the kind of knowledge that is needed to pass this course, and as they do not expect to learn anything new, they express little interest.

So, how does Evie handle the mathematics course then? As it turns out, the third phase indicates a new beginning for Evie. Since the first internship, a low degree of certainty has burdened her when referring to herself as a teacher in the classroom. As presented in the previous section, this low level of certainty has given her mother, Angela, a more prominent role concerning Evie's teacher education. However, during the mathematics education course, she once again starts to gain confidence in her own abilities, using her past experience in mathematics to re-negotiate the general tale of herself as a becoming teacher.

Before even examining how Evie re-negotiates her future teaching in this phase, it is implied that the main contributor to her altered state of modality can be explained by her perception of herself as highly proficient in mathematics. The experience of knowing mathematics becomes a significant part of her image of herself as a capable generalist teacher. This picture is confirmed when looking more closely at how she talks about herself in the third phase, in terms of her significant linguistic choices. Evie draws on several different social practices and figured worlds in relation to the experience that she gains during the mathematics education course. Through her negotiation and re-negotiation of previous and new experiences, a clear identification process emerges. This identification process concerns differences between prospective teachers and

can later be understood through a deviation between "we who know mathematics" and "the others who do not".

Only when entering the mathematics education course does Evie change as a prospective teacher, gaining strength and a sense of security. The mathematics education itself transforms her identity. The confident Evie returns in phase three.

High expectations on the mathematics education course

As described, Evie's primary interest in mathematics is the main reason for her attending this teacher education programme. Therefore, it is no surprise that she has high expectations of the course in mathematics education. She expresses her high hopes in several different ways. First, she expects a certain level of mathematics, then she expects a specific focus in the course, and finally, she intends to participate in this course in a particular way.

Before the course, Evie is eager to develop "more knowledge [of mathematics] than I have now … other ways of viewing the subject of mathematics … other ways of solving problems […] more how I can help students … maybe students, who don't think maths is fun … how I can get them interested?" (2012–12–04) Evie imagines a social practice where the specific social interaction is related to mathematics that might challenge her understanding in different ways. The common endeavour in mathematics education is to be challenged and to be able to use new knowledge in teaching. In this quest, the prospective teachers interact and try to understand how to teach mathematics. Evie is eager to participate. One can say that this is the moment Evie has been waiting for if one interprets the importance of the course in mathematics education. Dreaming of teaching mathematics in particular was a strong reason for why Evie decided to apply for the teacher education programme.

When Evie mentioned earlier that "I have always wanted to become a teacher", it related directly to the subject of mathematics and she now "hopes" that her knowledge in mathematics is sufficient. It is important to note that even though Evie considers herself to be highly proficient in mathematics, having entered the teacher education with the highest grades from upper secondary school, she is nevertheless unsure about the relation between her past participation in the mathematics classrooms and her future participation in the mathematics education course. Evie expects challenges in her mathematical understanding in several different ways and expresses an understanding that she now enters the

subject from the perspective of the teacher and no longer from the perspective as a student. This singles her out from the group of prospective teachers who were described previously as showing feelings of indifference, perhaps focusing more on their own performance as students in mathematics and less on taking in the new perspectives of teaching.

Of course, all prospective teachers expect a course where teachers' teaching and students' learning will be the primary focus. However, there is one significant difference. From field notes taken at the course introduction 2013–01–21, one can see that, while most of the prospective teachers expect the kind of level of the mathematics in the course to relate to the mathematics focused in upper primary, Evie and a few of her fellow prospective teachers have a slightly different view. Evie is not focused on the upper primary level as described in the national curriculum, Lgr11, when engaging in this discussion. She focuses on the student attending the mathematical classroom, specifically the gifted student. In her opinion, this means that a teacher needs to know how to teach lower secondary even though the entry is upper primary. Evie understands that she must know more mathematics than the mathematics taught in upper primary. My interpretation is that Evie, rather than expecting to learn the mathematics she is meant to taught at upper primary, instead expects to participate in a social practice that highlights methods for teaching and different ways of solving problems that could challenge any student.

Prospective teachers' past participation in mathematics classrooms contribute to their expectations of this course, as seen in the tale of Evie. Of course, this is obvious, almost common sense, but nevertheless, it is essential for the understanding of the identity development of prospective teachers. How the prospective teachers enter the specific mathematics courses and bring with them their previous past participation is the central question that is elaborated here concerning my own quest when writing the tale of Evie. How prospective teachers use their previous experiences when re-engaging and re-negotiating their expectations in relation to how the specific mathematics education courses develop their understanding of what it means to be a primary teacher is of vital importance. By learning about Evie's tale, it is possible to see how identity transformation is an ongoing dialogue between past and new experience.

In the next section, we follow Evie's re-negotiation concerning her consideration about herself as a good mathematician and the fact that she thinks of mathematical knowledge as essential for being a good teacher. It turns out, however, that Evie becomes somewhat disappointed with the first and second

subcourses, and this troubles her when pondering what it means to be a good prospective teacher, a good teacher, and even what it means to belong to a university.

Just like the upper secondary

Interestingly enough, even though Evie starts out from a nuanced understanding of what to expect from the mathematics courses, she is soon disappointed. From the very first week of the mathematics course, Evie has viewed herself as mathematically proficient and concludes that the mathematics education courses are not set up to teach her anything, but to teach most of her fellow prospective teachers the mathematics that she already understands. In comparison with prospective teachers ending up indifferent, Evie instead tries to find some meaningful ways of participating during the first parts of the course in mathematics education. She realises that, in relation to her fellow study-group members and most other prospective teachers in the class, she is highly skilful in mathematics and has the subject "more updated", to use her words.

She used her understanding of mathematics "to help others remember and understand". Evie points out in the interview from 2013–02–01 that her study-group members need help. Through the field notes from the first two weeks of the course, one can see how Evie takes a lot of responsibility, answers questions and tries to help fellow prospective teachers. In this, Evie recognises herself as a "helper". She becomes knowledgeable by being there to help others understand.

There is a large gap between her and the others: "I feel that I use a more mathematical language, and the other prospective teachers use more basic everyday language … this is something that I have with me from the kitchen table at home" (2013–02–01). In this early part of the course, Evie starts to contrast herself with the others. This is, for example, evident through the additive "and".

During the first two weeks of the course, Evie attends different seminars related to arithmetic. For example, calculating with whole numbers, multiplication, division and calculating fractions. Evie uses her time at these seminars to read course materials that are needed for future assignments while the others are working hard with their mathematics. On several occasions, she quickly manages the assignments given to her by the teacher educators and she concludes that it would take the majority much time to solve the problems. She

understands that the other prospective teachers need more time with the basic mathematics, but this means that she is not challenged in her education.

When indicating this observation from the field notes during this early stage of the course, she concludes that lectures related to mathematics are "quite" good because at the end of the lecture there might be some mathematics that challenges her "but the seminars are of no use" (2013–02–01) to her. She indicates this by using the adversative conjunction "but" and concludes that this course became exactly "like upper primary… that you want to get finished as quickly as possible" and that "it feels unnecessary to do mathematics for three hours on the things you already know" (2013–02–01).

Evie is quickly managing the mathematics, and it is from the observer's point of view, quite apparent that these seminars are not challenging at all for Evie. At this point, the mathematics course does not contribute positively to her experience of teacher education. In the middle of the mathematics education course, Evie admits that she "did expect a higher level [of mathematics] and thought that… wow… how will this end" (2013–04–11).

She is disappointed when it concerns the level of the mathematics that she needed in order to pass the exams. In contrast, many of her fellow prospective teachers struggle with the mathematics during the written exams and seem angry about what they consider the high level of mathematics needed to pass this course.

Evie does not get what she expects and therefore starts to contrast different elements of the mathematics education course against each other. The teacher educators very clearly promote a specific way of teaching mathematics in relation to the prospective teachers' future teaching, but when it comes to the teaching of mathematics itself at the course in mathematics education, her experience is that it resembles past school-related experience. Evie describes this: "there has been some conflicting information…because they say something during lectures… do not use the textbook… then when we are practising mathematics [at this course], it is page by page". The teaching Evie experiences in the mathematics course in her teacher education programme positions her in the same way as she has experienced being positioned as a participant in many other mathematical classrooms of her past. She enters with high hopes for something new, but experiences a teaching that in her opinion relies on the same methods as it questions.

This creates an extraordinary and sophisticated setting with many contradictions interesting to observe. Evie is critical about the mathematics education course. As described above, she directly objects to the teaching that is conducted in the mathematics courses in relation to the prospective teachers learning the basic mathematics, and even though she is more positive to the ideas about teaching mathematics to students in future classrooms promoted by the teacher educators, she is not fully aligning there either. One also should note the similarity to her statement from 2012–12–04 on page 116:

> I believe that one needs a mathematics textbook as departure… but then I think that students will not develop through working page after page… chapter after chapter… they will have the textbook as a foundation to fall back on… but then it is clear that they need to be challenged to develop in another way… they can use other material and construct by themselves. (2013–04–11)

This is a formula for Evie's future teaching but also a description of what she had expected from the teacher education when entering the mathematics course.

An identification process begins and evolves

Evie describes the social practice evolving during these ten weeks through the material processes "sit" and "calculate". In the field notes from these calculating practices and seminars, I have noted that I interpreted it to be a typical mathematical classroom where students were holding up their hand waiting for help while Evie had finished her assignments a long time ago. However, the common endeavour for most of the students was to learn and master, or at least manage, the basic mathematics taught.

Evie regards herself as a prospective teacher who has all the knowledge that is needed to participate in this course. The importance of having this kind of knowledge is slowly recognised by Evie as a significant qualification when it comes to being able to develop into a proficient teacher in mathematics. Some of the literature that the prospective teachers read during the course promotes ideas related to what is known as Mathematical Knowledge for Teaching. This literature and the ideas proposed by the teacher educators confirm that one needs a lot of mathematics to become a good teacher, and this makes Evie realise that "I believe that it is hard to teach the things that you do not know" (2013–02–01). She later points out that "I have an easier job making students understand than someone that does not have as much knowledge […] I do believe that it is

hard to know how to help students if one does not have the proper knowledge in mathematics that one needs" (2013–04–11).

Concerning this, Evie develops a sense of professional attitude that aligns with the elements of a figured world of her having the right mathematical prerequisite, a figured world also confirmed by the teacher educators. The point is that this gets problematic for Evie concerning how she participates in this course in mathematics education. She realises that the way the content is taught at teacher education is directed towards the "others", the prospective teachers who do not know mathematics. The first two subcourses are directed towards the others, and not her. She undoubtedly understands why they have to focus on the others, but she had wished for more.

Evie becomes a passive participant. She feels neglected, or in other words, not prioritised, by the mathematics education course that she has longed for. In this process, Evie starts to question ability of the "others" to attend this course and to teach mathematics in the future. Evie is concerned about the other prospective teachers in her study group but tries to negotiate some meaning into the situation. She tries to help her fellow group members with their mathematics and emphasises that this is:

> [b]oth positive and negative… those who do not understand can have some use of those of us, that do … at the same time we who know mathematics need to realise that everyone else doesn't know mathematics… maybe we can develop an understanding that children are struggling… the school was never any problem for me… you get a picture of what it can be like for students… that mathematics can be hard. (2013–02–01)

Evie's skills in mathematics and her eagerness to explain and help others causes problems in her relationships with her fellow prospective teachers. When it relates to mathematics, the otherwise withdrawn Evie is more active, and when she explains to the other prospective teachers, they seem annoyed, something that Evie experiences and mentions on one occasion. Even though she feels that it is problematic to "own the mathematics", the experience of seeing the others struggle is positive. Through the field notes during the first two subcourses, it is obvious that during seminars and study groups, Evie tries to inform the other prospective teachers about how to solve different tasks or problems, but there is a tension within the group. Some are resisting Evie as a helper, and look to the teacher educators instead. Evie says that she "believes that in my study group there are not many interested in mathematics… especially one person in the

group can be aggressive and in a bad mood if I explain my view on the thing… she feels inferior, so I believe that she maybe would be better off in another group" (2013–04–11).

Evie is positioned as mathematically strong, through her past participation, the literature read at the mathematics education course, and by the teacher educators. In her participation in different figured worlds and social practices, she develops a sense of herself as different from the others. Being different is positive for Evie. Her identity as a future teacher of mathematics is strengthened when using the "others" as discursive counterparts. These "others" include both fellow prospective teachers lacking the required mathematics knowledge as well as those in the mathematics education course itself.

As Evie participates in the teacher education programme, she draws attention to the teacher educators' proposals that mathematics is essential when teaching mathematics. She also draws attention to the norms reflected in society when discussing what kind of prospective teachers are needed. One can view how these two discursive arenas, the social practice of teacher education and the norms reflected in politics and society, contribute to Evie's engagement in a figured world where her mathematical knowledge is valued and prioritised.

The identification process involving "we and the others" manifests in the tension between social practices and figured worlds that value the "right mathematical prerequisites" and Evie "feeling neglected" by the teacher educators. It can even be interpreted as a direct consequence of difference between what she first expected and what she experienced that she got. She expected a much higher level of mathematics and a specific focus in the course as well as being allowed to participate in a specific way.

The feeling of the "we" versus the "other" grows stronger

Another interesting phenomenon arises during the second part of the mathematics education course, subcourses three and four. As explained previously, the first two 7.5 ECTS credits courses has a stronger connection to the subject of mathematics itself. In the last two 7.5 ECTS credits courses in mathematics education, the mathematics is not that visible, and Evie's study group seems to work well during the last two 7.5 ECTS credits courses because Evie "feels that one suddenly is at the same level, and that is a blessing" (2013–05–31).

The field notes taken during the second part of the course show that the other prospective teachers seem relieved that the courses in mathematics are over. Some of them still have exams to pass and are not pleased with that situation. They are nervous about potentially not passing because they found the mathematics too hard. Moreover, they are critical to the content which they sometimes feel is irrelevant to their future teaching. Two of the prospective teachers express the feeling that now, when the last two courses are starting, they can finally relax and start working part time to earn money. They have had to stop working because the two first subcourses were too difficult to manage on less than full-time studies. The emphasis on the two last subcourses as providing more time to relax dominates every discussion as well as all the lectures, seminars and study groups that I attend.

However, Evie, who is specifically interested in mathematics education, has longed for the last two courses. She emphasises that "it seems to be an exciting course, but it is hard… they now raise the standard… one is to assess, and assessment is harder and is the thing that takes time" (2013–04–11). Once again, Evie expects a specific social interaction based on an endeavour that is in opposition to the approach of her fellow prospective teachers. While many of the others express relief at having a lighter workload and want to focus on relaxing, Evie does the opposite.

Because many of the prospective teachers are inactive during the last two courses, Evie and some others tend to get together across the groups. They form a subgroup of like-minded students when possible and share their thoughts about the "others" and the education itself. It is in this phase of the study that Evie and her friends position themselves as "we" in relation to "the others". The distinction becomes very clear. Evie uses the pronoun "they" many times to relate to the fellow prospective teachers who view the courses or content differently from the way she and her friends see it.

What is important and interesting to consider is that every prospective teacher in the class expresses that the last two subcourses are the "best" during the 20-week course. However, the reasons for this are quite different. Those within Evie's study group who struggled with the mathematics in subcourses 1 and 2 have actually relaxed during the last ten weeks of subcourses 3 and 4. They have not put in extra effort and simply done as little as possible. One prospective teacher says something like "during the maths course [referring to subcourses 1 and 2], you were like a filled balloon, now all the air has left, and you are so tired" (field notes 2013–04–15). They actively choose which lectures they have

to attend to pass and what teaching assignments they can take outside the university to earn money. When the group is preparing an oral assignment, one prospective teacher says that "this will be fine – we will pass anyway" (field notes 2013–04–19). In contrast, there are some prospective teachers, including Evie, who view the last couple of weeks as important. These prospective teachers work hard throughout subcourses 3 and 4. The last ten weeks align more with their general expectations for the course, and they are pleased with the content given.

Angela's role with Evie shifts

During this phase, it becomes clear that Evie does not re-engage with her mother's teaching and experience as a teacher in the same way as she did before. Angela's role as the primary contributor – in the form of an educational advisor, vital moral support, and a teacher role model who knows the pedagogical language – seems to fade in relation. She is no longer Evie's educational foundation in the same way as she was before. Evie now clearly builds on her mathematics background instead. In this turn, Angela has begun to recognise Evie as a resource for *her* teaching.

One example of this is when Angela was put in charge of replacing the mathematics textbook scheme the school used. Angela became particularly interested in one assignment that Evie and her study group were working on in the teacher education. This assignment contained an analysis of a mathematics textbook of the group's own choosing and how it relates to the new curriculum from 2011, Lgr 11. Angela proposes, according to Evie, the review of one specific mathematics textbook, and Evie concludes that "we did a small assignment in one seminar where we analysed a new mathematics textbook that was supposed to align with Lgr 11, and they discussed whether to change to this new book and wondered what we thought about it" (2013–05–31). The status of the study group is elevated by the fact that real teachers turn to them for advice, and this gives some legitimacy to the education itself.

As it turns out, this analysis of the textbook is the final contribution to Angela's decision to recommend this particular textbook to her teaching community. From Evie's point of view, this reinforces the position that Angela now relies on Evie's participation in the teacher education to get teaching advice and material. However, this is not surprising because Angela has said earlier in an interview that "Evie's education is good for me too" (2012–09–10) and when

entering the third subcourse, Evie concludes, "Well, now she wants material… but that is more for her teaching, all exercises and booklets" (2013–04–11).

Expressing security when discussing future teaching

At the very beginning of this phase, Evie explains her understanding of mathematics teaching:

> First, [it is] to assess students' knowledge in relation to the curriculum and the mathematics textbook … what it [mathematics textbook] actually presents and then trying to get it together […] It is evident that the mathematics textbook does not align entirely with the curriculum … so one has to know what the material is emphasising to be able to teach the things that are missing. (2013–02–01)

Evie promotes a conscious way of using a textbook in her future teaching, as she also did in phases one and two. However, Evie re-negotiates the use of the textbook to align her tale with the mathematics education course. She develops the ability to express a more complex critical standpoint regarding the use of textbooks. In phases one and two, she merely critiques working page by page, but now she re-engages and uses the content in the mathematics education course to explain why she does not consider it good enough to teach with the book like that. For example, she argues that the textbook does not necessarily cover the curriculum. The critique in early phases of teachers relying solely on the book has changed into a nuanced discussion about textbooks not covering the curriculum and why it is important to be observant as a teacher. That the textbook does not cover all the mathematics needed is something she says with high linguistic validity in the previous quotation, using strong and clear language such as "it is evident", "one has to know" and "to be able to teach". There is a strong causal relationship in Evie's discussion between knowing the material in relation to the curriculum and being able to teach successfully, and she is able to express this in a convincing way through controlling core words central to the subject matter.

When it comes to using textbooks, the message from the teacher education is clear. Teacher educators are "pretty positive about using different methods but pretty negative to some mathematics textbooks" (2013–02–01). However, some teacher educators even "want us to drop the textbook and to encourage us to produce our material or change the mathematics textbook […] I agree with this to some extent" (2013–02–01). Evie re-negotiates this standpoint expressed by

the educators in relation to her own experience and then engages in the kind of teaching that is supposed to complement the mathematics textbook. She comes across as strong in her arguments:

> I believe that mathematics becomes more natural if you think of daily situations […] but I think that you need to learn that it is not only the everyday life … because when you are at the mathematics lesson you need to learn mathematics […] addition and subtraction […] but many have an easier time understanding mathematics when connecting it to everyday life. (2013–02–01)

Here, the mental process of "believe" is used to imagine a physical world of doing rather than doing them in real life. The use of the relational process "becomes" indicates that if a student can get involved in this "mind action", mathematics becomes easier. The adversative conjunction "but" indicates a contradiction that solely using everyday situation and reality-based learning is not enough.

It is clear that Evie raises objections to some teacher educators who have indicated that to "drop the textbook" is the best way of handling the new landscape of teaching mathematics. Evie is developing a critical stance against the mathematics education course, and this becomes a large part of her development of a mathematics teacher identity. Concerning this, Evie develops a view of her future teaching that is prevalent throughout the remainder of the study. Evie is actively using the mathematics education itself in her argumentation to promote her slightly different future teaching.

> I do not believe that I will throw the textbook away, but maybe … I will take away some assignments, for example, routine tasks or maybe bring some routine assignments together into a problem-solving activity. (2013–04–11)

As can be seen in the previous phases in relation to this one, Evie is transforming her future use of the textbook to align with and merge into a way of teaching that covers the curriculum even though she does not entirely accept the teaching promoted by the teacher education programme. As highlighted in phase two, this declaration about her future teaching is highly similar to the one before, but instead of saying, "I would probably depart from a mathematics textbook", she now says that "I do not believe that I will throw the textbook away". This can be interpreted as a response to the teachers in the mathematics teacher education as well as a stronger justification.

Emerging issues in the third phase

This phase is characterised by the higher degree of certainty that Evie expresses. Evie started her teacher education with high modality, and then through her internship experience, her modality became low, and now her participation in the mathematics education course made her modality higher again. In the third phase, Evie becomes the "helper", and she becomes recognised as mathematically proficient through helping others. She has the ability to become a helper because of her mathematical knowledge.

This ongoing identification process between the "we" and the "others" during this phase is interesting to follow. It seems that the "subject of mathematics" plays a large part in this identification process and is a central part of the figured worlds Evie chooses to engage in to justify her understanding of what is important when becoming a teacher. This process can be divided into two steps. First, her thoughts concern the subject of mathematics itself as central in relation to the prospective teachers' participation during the first two courses in mathematics education. Therefore, Evie is prepared to wait the education out while the others struggle with the essential mathematics knowledge that she already masters, and she is ready to assist. Secondly, Evie "finalises" the identification process during the last stages of the course in relation to the other prospective teachers, who are not interested in engaging in the content. Evie's expectations of how they should participate and the specific social interaction in the mathematics education course seem not to be met. Most importantly, in this identification process, social practices other than the teacher education become relevant to Evie in terms of meeting her educational concerns.

Phase 4: Becoming a confident leader in the classroom

The second internship is during the fifth term, approximately two years and four months after entering teacher education. The primary focus of this internship is on mathematics education, as this stage of the teacher education programme follows the 30 ECTS credits course in mathematics education. During this internship, I attended lessons and some meetings over the course of one week.

During phase three of the mathematics education course, Evie occasionally mentions her first internship experience. Here, she expresses quite a high regard for the teaching carried out by the teachers at the internship: "They had a good plan for their lessons … trying to have a unified course […] they [teacher educators] would have accepted their [internship supervisors] teaching because

students do not need to do all the assignments in the mathematics textbook" (2013–04–11).

However, in the last interview during phase four (2013–12–11), Evie directly brings up the past internship, questioning both the amount of time she got to spend teaching and the internship supervisors themselves.

Evie The question is how much teaching experience did I get on the first internship …?

Researcher Okay … but now in retrospect … how much would you have liked to have had?

Evie I would like to have had more … that, I know… but I think that depends on the supervisors … that they are much more engaged here [internship number two] than on the former one.

Researcher More engaged with the students or more engaged in teaching or more engaged in you …

Evie Honestly… they are more engaged overall …

Evie then indicates that "I think I am different now". She thinks that changing internship schools was most important: "I believe that it is important that I am at a new school." Once again, she engages in a discussion about the teachers at this new school and how friendly they are. Then, at the end of this part of the interview, she concludes, "Well, at the end, it depends on which internship supervisor you get".

The field notes from the first day of visiting Evie, 2013–12–03 indicate a significant shift in Evie's participation concerning the teaching of mathematics:

Field notes: I place myself in the classroom and some students start to enter. They look at me and then sit down on their chairs. Evie points out that they are used to having many different persons attending their lessons. There is some noise in the classroom, and Evie positions herself in front of the class, and the class starts to lower their voices […] Evie is handing out mathematics textbooks and asks if someone has a copy in his or her bag. She positions herself once again in front of the class and the class lower their voices once more. Now the internship supervisor enters the room and positions herself to the side of the classroom. Evie starts the lesson by saying, "You have been working on

> problem-solving and today we are going to work in a different way than before". Evie keeps on in a distinct voice and describes that they will work with problem-solving, backwards […] Evie is standing in front of the class and directs the discussions […] "What kind of information do we get?" […]. She is remarkably more secure in her role than before and in relation to the course moments. She is almost hard in her tone, standing with her back straight. Evie marks distinctly when the classroom is too noisy, and the students immediately lower their voices…

The kind of teaching observed and found in the field notes relates much to the type of teaching explained from Evie's prior school-related experience. There was always a short lecture, Evie has recalled, and now she follows that model. After the lecture, she introduces a way of working that is related to the assignments in the mathematics textbook. These examples take up much time, which means that there is not much time left for the students to work on their own.

Soccer referee initiative

Evie now acts with confidence. She is straightforward in her manner as a mathematics teacher after the summer break. This observation is brought up a few days later in the final interview, 2013–12–11. The shift will be termed as "embodying a teacher position".

Researcher: So, in some way, you felt more secure […] How do you experience this?

Evie: I have received more training to stand in front of students and speak. More teaching hours on this internship than the other [the first internship], which is probably the most significant difference.

Researcher: But have you spoken much about [the changes in] your voice? That you use your voice in an entirely different way now than you did before […].

Evie: No, I think that a lot of this is from my soccer referee career and different referee courses and refereeing soccer at different levels. It comes naturally – how one uses one's voice for speaking to the players on the soccer field … it is the same way one speaks to students in the classroom.

Researcher: But when did you begin this referee position?

Evie: I began refereeing at a senior level during the summer of 2010 … but then the initiative started during this winter when I found out … found out that I was nominated to attend the next level in connection to the "elite camp for girls" this summer.

Researcher: Has anyone besides me pointed this out, about your voice?

Evie: No, no one from the [teacher] education, but the inspectors [from the Swedish National Soccer Association] when I referee [laughing], they point out that I talk correctly and distinct when I speak with the players.

By looking closer at this transcript, I can see how I propose a perceived change in her security through the mental processes "felt" and "experience", which are quite vague words, and Evie directly responds with the verbal process "speak", which is very much concrete in relation to me asking how she feels and experiencing things. She understands what I am after and connects the increased security directly to her getting to speak more frequently in front of people. The material process "stand" indicates that this way of participating in the mathematics classroom comes from her very physical participation in another social practice, namely, standing in front of a group of soccer players. When trying to identify the origin of this change, Evie brings in a totally new reference for the first time – her "soccer referee career".

As it turns out, Evie's participation in this referee education is important for her role as a mathematics teacher. Her choice of words, for example, when she says "one speaks to students" is therefore important in this transcript. Here, the verbal process "speak" is relational between the management of a soccer field and a mathematics classroom. Speaking with soccer players playing soccer and students learning mathematics can, through the choice of words, be interpreted as equal ways of participating and communicating. Evie re-interprets what she considers successful teaching to align with her as a participant in the social practice of refereeing. This is a social practice in which she is successful and feels comfortable. She takes a way of being from one social practice and applies it to another.

In the last interruption by me, the verbal process "point this out" is used to understand if teacher education has indicated this change in Evie's participation. Evie emphasises that no one from the educational side has highlighted this

change but uses the verbal processes "point out" and "speak" in relation to inspectors from the Swedish National Soccer Association. She explains that the inspectors have pointed out that "I speak well and distinctly". The conjunction "but" used in the last answer is used to exclude the teacher education from the discussion and promote the inspectors. This is an adversative conjunction, which means that there is something contrary to what one might expect.

Evie negotiates her mathematics teaching in relation to the response from the inspectors. This is different than the response from the teacher education and even the internship supervisors. In the referee education, Evie participates in a social practice where she is viewed as an individual with demanding goals to achieve. The instructors are there for one reason, and that is to coach her so that she can reach the high standards. More critically, Evie experienced getting instant feedback on her immediate social interactions during and after actual soccer games where she is a referee. To become a soccer referee at national level is demanding, and the common endeavour needs to be mastered. In this process, Evie gets the coaching she needs to become a confident teacher in mathematics.

The impact of her mother, Angela

Evie is well aware of the impact Angela has had on her teacher education and mathematics teacher education. However, as highlighted in the previous phase, Angela's position in relation to Evie has been re-negotiated during the study, and at the end of the study, she has become more invisible in the interviews. In the last interview, two years and six months after the first one, Evie concludes that her mother has contributed to her education in many ways.

> We [Evie and Angela] still discuss things, and now we talk much about teaching situations … and she is active [as a teacher], and now I feel active [as a teacher] here on internship… well, now it feels that we are more in the same situation… because we are teaching the same level [Grade 5] … so far we have discussed teaching and planning of lessons a lot […] we do agree quite much … but then I try to do things in my way … I think that it has depended on this [a discussion about feeling more secure] … more confident in myself … and then I will apply for jobs within one and a half year … and then the application must be on my merits, and I need to have more discussions with colleagues on that school

> … I think that these insights … insights like this have emerged. (2013–12–11)

It is interesting to look back at the initial interview when Evie concluded that "I come from a mathematics family, and everybody is interested in mathematics […] We sometimes talk (about educational things), but at the same time, you want to change in relation to your own experience". At the beginning of the study, Evie became dependent on Angela's expertise in relation to educational matters, and then a sort of deliberation process merged them into more equal participants during the mathematics education course. However, the contributing factors that made this deliberation process possible were Evie's confidence in relation to the mathematics content and her referee education course conducted by the Swedish National Soccer Federation. It is also clear that Evie needed Angela in order to develop a sense of security and to legitimatise her participation in what she considers useful while participating in the teacher education programme. But most important is that Evie now regards herself and Angela as equals, feeling active as a teacher and feeling able to share that experience with her mother.

Emerging issues in this fourth phase

The modality or Evie's degree of certainty becomes strong in this phase. It is clearly stronger than before, and her experience of being and developing as a soccer referee becomes a new central part of her patterns in her participation. 'Evie as a future teacher' is formed when she moulds her way of acting as a referee into the tales of herself as a becoming teacher. I interpret that during this last phase she considers her mother Angela as a person who has a similar experience as she herself now has. They are both teachers teaching mathematics in upper primary school. Evie now experiences being in the same place where Angela is. She has conquered a sense of being a teacher.

The tale of Lisa

Lisa's identity development is a complex tale that includes both stability and change. This complex tale is characterised by Lisa's search for teaching strategies that relate to her prior experiences with school mathematics. In her quest, Lisa brings many different teaching strategies and models related to teaching from a diverse range of different social practices into her tale of present experience or imagined mathematics teaching. These different parts all fit into

a figured world of teaching and learning mathematics that might relate to a specific figurative classroom, a classroom where Lisa experiences great success and joy. In relation to this, one needs to remember that Lisa describes herself as extremely competitive as an athlete, as she has played soccer on a high national level.

Throughout her teacher education programme, Lisa refrains from identifying as a teacher when talking about herself as a prospective teacher of mathematics. She consistently says that there may not be any future for her in the profession. Lisa needed something to do after secondary school, and if you do not know what you want to do, then "you can always be a teacher […] teacher education is always a possible option" (2011–08–31). Lisa identifies as a person who is interested in mathematics and claims that when she engages in something, she puts all her effort into it: "Even if I am not sure, I always do my best" (2011–08–31).

Although Lisa is uncertain about her future profession, she is ambitious in regard to the outcome of her education. She wants to develop "an extreme pedagogical knowledge and be able to explain things in many different ways, so it suits many different students … everyone learns differently, and all have various ways of understanding … not just giving lectures but also engage students and let them be a part of the lesson" (2011–08–31).

In relation to the identity indicators found in the literature review, three phases can be understood as to how Lisa relates to a teaching model and how patterns in her discursive engagement with the model become increasingly complicated.

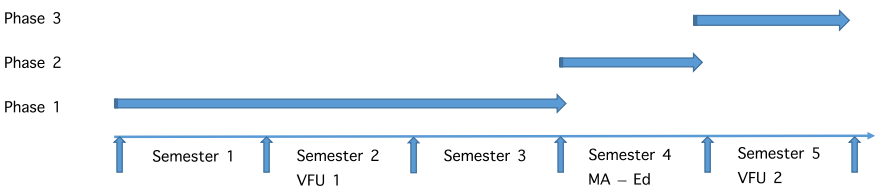

Fig. 13. A timeline visualising the different phases of Lisa's identity development

The figured world of performative mathematics

The figured world Lisa engages in is the world of performative mathematics. The recognisable characters and actors within this figured world are teachers teaching mathematics in a unified course structure and students learning mathematics individually. Aspects valued within this figured world are the mathematics knowledge of the teachers, the teacher's ability to individualise mathematics explanations in relation to students, and most important, the students' ability to mathematise. In this figured world students enjoy being good at mathematics.

The possibility for gifted students to engage in the teaching situation is central within this figured world and concerns the right to show what one masters mathematically, and by that, be part of the teaching situation. Engagement concerns being challenged by the mathematics textbook and/or competitive teaching strategies. Keywords that are generated back into the tale of Lisa in relation to students' participation in the mathematics classroom are 'playful', 'joyful' and 'challenging'.

The tale of Lisa is described in three different phases. The three different phases mirror her present participation in relation to the figured world of performative mathematics. Across the phases there are three themes that come up as affiliated with (1) how her commitment to mathematics is coupled with a picture of herself as a key figure to the students' understanding; (2) competitions as a key to productive and effective teaching; and (3) her view of mathematics as a subject.

In phase one Lisa contrasts her lower and upper primary school experience with one another through engaging in the figured world of performative mathematics. She does this to promote the teaching at upper primary school. In this classroom, she was successful, and she recollects the memories in a mathematics classroom that involve competitions or performance in particular. Later in this phase, this experience is moulded and fused with the social practice where her internship supervisor, who I will refer to as Mr Higgins, is a vital part.

Phase two that is related to the mathematics education course marks a transition period in which Lisa develops a somewhat troublesome relationship to the mathematics education course. On the one hand, Lisa challenges her prior experience and re-negotiates the figured world of performative mathematics through new experiences in the mathematics education course, but on the other

hand, in this process, she develops a critical stance towards the kind of teaching that is promoted by the teacher educators. Lisa always agrees with the teacher educators when present, but in conversations with her fellow prospective teachers, Dina and Kira, as well as in the interviews with me, she expresses other opinions. Her critical stance can also be viewed in relation to her opinion that her fellow prospective teachers' lack the required knowledge and engagement in mathematics.

The last phase starts at the end of the mathematics education course. Although Lisa thinks that this has been the best and most interesting course so far in her teacher education experience, she does not accept the teacher educators' ways of teaching and learning mathematics. She aligns with the intentions of the figured world of performative mathematics that the teacher educators do not emphasise. At first glance, one may interpret this stance as a regression to the first phase, but it is not. On the contrary, Lisa continues to negotiate teaching and learning mathematics and brings new experiences and teaching strategies into her tale as a teacher-in-training.

Phase 1: Finding security in the past and present experience

In this phase, Lisa re-engages in lower and upper primary school experiences and promotes the latter where she recalls being successful as a student. The experience from upper secondary school is moulded during phase one, as it is fused with Mr Higgins' teaching during Lisa's first internship (VFU 1).

The upper primary school as starting point

There are two main foci in Lisa's description of her experience with primary school mathematics, namely, the character of the material they used and the role of in-class competitions as an educational strategy. In terms of how she phrases it all, it is noticeable that, from an early age in lower primary, she developed a passion for mathematics as a subject. She credits this passion to the fact that she found mathematics easy and enjoyable, even though she also questions the quality of her mathematics experience at lower primary. She points out that

> the stencils were very easy […] one does not get motivated by stencils […] stencils and stencils … you just did stencils because you had to […] there was no structure, they fetched a stencil randomly … everyone got different stencils […] it was a stencil about that and a stencil about something else, so it was very messy … I believe. (2011–08–31)

Thinking of mathematics as taught in her first few years at school, Lisa mainly remembers much work with different materials. Lisa's main insight from this time as a student was that she had no clue as to why she was doing what she was expected to do. The teacher at lower primary perhaps had some idea about how the different exercises related to one another, but Lisa remembers that, as a student, she did not see the connections.

Rather Lisa's specific interest in mathematics came when participating in upper primary school, more precisely, when she at age ten got her first mathematics textbook in Grade 4:

> In the mathematics textbook … at least … everything was within … one knew that you have done these many pages … then you feel more motivated to carry on […] when you got a mathematics textbook, you followed a certain pattern … if you were working with geometry … you did that for a while. (2011–08–31)

Concerning her upper primary school experience, Lisa talks about how she perceives herself as good in mathematics, and then "lower secondary school was okay. It became harder, but it was not really hard… yes, then in the upper secondary, I chose a direction with as much mathematics as possible, so I thought it was fun" (2011–08–31). She enjoyed mathematics and being a student in the mathematics classroom because "it [mathematics] is logic … one does not need to think… okay, you need to think, but there are certain rules about how things are working, and that's the way it is… and there is nothing you can do about it" (2011–08–31). Lisa studied much mathematics during upper secondary school, much more than most other prospective teachers at the primary teacher education programme normally have studied.

Lisa re-engages and re-negotiates her experience from lower and upper secondary, contrasting them into a dichotomy to justify good teaching from her point of view. Her lower primary experience is marked with negative polarity, for example, in relation to motivation and structure. She experienced varied teaching through *stencils* and no *mathematics textbook*, and when she describes her experience, these nouns becomes synonymous with negative teaching models. The *textbook* is also used when she describes upper primary experience, but this time, with no negative polarity. Lisa emphasises her upper primary experience, when she was able to show her mathematical ability. The use of a textbook now becomes synonymous with positive teaching models. In upper

primary school, Lisa highlights an important specific social interaction for her – that of competitions when teaching and learning mathematics.

To be seen as a knowledgeable student through in-class competition

During the first interview (2011–08–31), Lisa recalls her two teachers from upper primary school as examples of positive teaching models. At this stage, these two teachers became role-models of good teaching.

> Both were extremely interested … they taught playfully … they were a little more engaged … at the right level when discussing things … at the same time, they saw the individual and could help individually … we had a lot of competitions … in order to make it all a little more challenging … and you get better results [with competitions] because you are more engaged …you get interested. (2011–08–31)

Early on in the study, these two teachers and their teaching come across as important in the figured world that guides Lisa's tale of herself as a person in relation to teacher education. Lisa relates the collective way of being in the teaching situations to exemplify the use of the mathematics textbook and the use of competitions when teaching and learning mathematics. By promoting competitions as an educational strategy, Lisa justifies her right to show her mathematical ability and to remain a recognised character in relation to the subject, just as she is accustomed to from her past experience in school.

Lisa's way of participating in this competitive teaching is central when she explains why she has enrolled in teacher education. Her positive experience of attending these upper primary mathematics classrooms is mentioned as the primary reason for her choice of joining this education and the most important single contributor to her interest in and understanding of mathematics.

Finally, it can be observed through the analysis that Lisa does not position herself as the main actor in this first part of phase one in her tale. Instead, the main actor is more anonymous, as she refers to herself in terms of "one", as a student in general. Only three times during the first part of this phase does Lisa makes herself visible through the use of the first person singular in the mental and material processes: "I believe", "I chose" and "I thought". Through her choice of pronoun, she distances herself from the new role of being a prospective teacher that comes with entering teacher education. The first time she includes herself into the teaching situation is when she uses the pronoun "we" when relating to in-class competitions as a teaching strategy. She re-

engages with somewhat less distance here, as she at least chooses the first person in the plural, but I interpret that she nevertheless does not put herself in the place of the teacher as a person talking about herself as "I" would imply. Also important to consider is how Lisa does not refer back using the past tense, which could be expected when retelling past experience. Instead, she is using the present tense as if she was there at that moment in the past. I therefore interpret that Lisa, in the beginning of the study, positioned herself more as a student in the previous classroom than a prospective teacher at the beginning of her teacher education.

Introducing Lisa's internship supervisor, Mr Higgins

As it turned out, Lisa's internship experiences became most important for her tale of herself as a teacher-to-be. For that reason, her internship supervisor Mr Higgins and his teaching will be briefly introduced. This section can be read as highlighting selected important aspects of Higgins' instructional approach to teaching. He talks much of structure, organisation, competitions and tests but less of the subject itself.

I meet Higgins for the first time approximately two months before Lisa's first internship. The observations and interview are done on the first of February 2012, mainly to develop an understanding of the kind of social practice that Lisa is about to attend.

Describing his instructional approach, Higgins elaborates on the structure of the lesson and declares that Lisa will participate in mathematics lessons that can be somewhat different from day to day. However, the beginning of the lessons is always the same. Every lesson starts with a short lecture followed by some work, either individually in the mathematics textbook or group work with an activity. He points out that he needs to assist many students individually, and therefore, he uses a mathematics textbook: "It is pretty comfortable to have a mathematical textbook so that some [students] can work at their own pace while you as a teacher help specific individuals" (interview with Higgins, 2012–02–01).

Higgins makes consistent use of competitions when teaching mathematics. It is a central point for him to make the students compete with themselves, but he adds that there may be some competition between the students as well. Higgins is well aware of current debates among teachers and teacher educators and the

criticism of using competitions and competitive teaching in relation to teaching mathematics.

One example of how Higgins uses competitions is when the class works with multiplication.

> We have multiplication every third week […] we do it [a test] both on Mondays and Fridays … on time … it might seem a little stressful and inconvenient … but they like it very much because it is easy to measure results against oneself.

Interestingly, independently from each other, Higgins and Lisa use the same notions when talking about teaching mathematics, even though one can interpret that there are differences.

Higgins' teaching: A wow factor in Lisa's internship experience

The first internship was conducted during the second term approximately eight months after entering the teacher education. At the first internship, prospective teachers have some teaching assignments, but they are not expected to teach to a large extent. In this part of the first phase, Lisa experiences teaching that falls in line with her figured world of teaching and learning mathematics. It resembles the teaching she recalls from upper primary school.

Lisa is impressed after her first three weeks attending Higgins' class:

> I think he explains in a way that is very close to students ... it is very close to students, and it is ... it is at their level of understanding ... and it is very playful all the time […] they [students] are engaged in everything they do ... then they have tests in mathematics where the competitive instinct comes into play ... a good working pace, and when he says something, it becomes fascinating ... everyone gets inspired and respects him [long pause] and he has it ... competitions ... all the time ... I am very impressed with him as a teacher and would I ... I would be like him. (2012–04–23)

During this internship, Lisa is overwhelmed by the teaching she experiences. Her past experience as a student who has gladly participated in competitive settings in mathematics is reinforced as valid in her internship school setting. However, she talks about the mathematics textbook slightly differently.

> Many students are very competitive, and they want to get as far as possible in the mathematics textbook ... and they are very eager and do not focus enough on the tasks ... but I think that the teachers [Higgins and one of his colleagues] are skilled in lowering the working pace and getting students to focus on the tasks. (2012–04–23)

In Lisa's point of view, it seems that Higgins can master doing everything that is unconventional very well: "I think he is very spontaneous and has more playful teaching [laughing] and it is accepted" (2012–04–23). Higgins does not only pose questions and search for answers but also engages students in some conversation concerning the subject. Lisa wants to become a teacher like Higgins because he

> has outstanding pedagogical ability and can explain in many different ways so that it suits many different individuals. Everyone learns differently, and all have various ways of understanding. Not just lectures, but he is engaging students and lets them be a part of the situation. They [teachers] should ask questions and control that students keep up with the lecture. (2012–04–23)

Lisa's participation in Higgins' teaching contributes to this study with more complex discursive patterns to observe in relation to competitive teaching. Competitive teaching remains a significant linguistic choice for Lisa during and after her internship in Higgins's classroom, but a small change can be identified. Lisa starts to align with Higgins' view of competitions in relation to the mathematics textbook and is challenged in her past experience as a student. She herself had a positive experience of the mathematics textbook as a student, as she was ahead of the other students in the class most of the time. However, as earlier described, Higgins is aware of the fact that his students compete about the number of pages completed, and he perceives this as negative and emphasises the need to slow students down when competing becomes the main focus.

As an educational strategy, at the beginning of the first phase of the study, in-class competitions are marked only with positive polarity. After attending the first internship, Lisa still talks about competitions in general with positive polarity, however, when talking about competitions concerning the mathematics textbook, negative polarity can be seen.

Lisa re-engages and engages positively in two different teaching situations thus far along in the first phase of the study, first with her upper primary experience

and then Higgins' teaching. These two different teaching situations are similar in many ways, and they even confirm one another. Lisa regards the teachers in both teaching situations as knowledgeable and showing great pedagogical ability, and they let students engage in the teaching situation. The teaching is playful and challenging for all students.

Lisa comes back to the same teaching situation over and over again, remaining in the figured world of performative mathematics. This figured world is central in her tale of good teachers and the kind of teacher she can picture herself becoming. She uses this figured world as a centre and links different lived experience to it inter-textually, thus organizing her experiences. First in relation to the teacher she wants to become and second in relation to her upper primary experience, and finally, in relation to the internship experience. They are all used to confirm her positive experience of the figured world of performative mathematics.

Lisa's view of Higgins' teaching as non-traditional

Lisa describes Higgins' teaching as "new" in contrast to what is requested by, for example, politicians and the media. Politicians want it "as it was when they were young… more organised". In Lisa's opinion, the values that are shared amongst politicians in the media debate are based on discipline because students in general cannot behave properly nowadays.

Later, during the internship, Lisa describes her disappointment in "them" [politicians] and how teaching is conceptualised in the debate. When doing so, Lisa makes a connection between the politicians and the figured world of traditional teaching. She expresses a critical stance to traditional teaching and how the politicians describe teaching as a smooth and easy, which does not correlate with her internship experience.

> I think they present it [teaching] as too easy in comparison to what it is … I think that there has been a view of the teacher as a priest ... but nowadays, the focus is on something else ... focus is on the children who cannot behave ... what bothers me is that they focus more on the bad teachers than on the good teachers ... so it makes the profession less valuable ... although it is an equally long education as anything else ... it is not seen as a great profession, or what to say, because of them ... (2012–04–23)

Mathematics is what it is… and is taught that way

There are three themes in Lisa's descriptions of the subject of mathematics in relation to teaching. The first relates to the structure of the subject of mathematics; the second refers to who is able to learn mathematics and; the third how the teaching of mathematics is carried out.

Lisa starts by pointing out that

> mathematics is like … logic … it is right or wrong … mathematics is pre-decided … either the task is right or it is wrong … while in Swedish (school subject) and Pedagogy (university subject), for example, there is no right or wrong … it is the context … mathematics has right or wrong … it is more structured, and there is more to fall back on … while Swedish is so wide … and there are so many things you need to think about. (2012–04–23)

In relation to experiencing the subjects as different from one another, Lisa argues that the teaching of mathematics also differs from the teaching of other subjects. Lisa stresses that

> teaching mathematics is more like giving a lecture … helping them [students] to read and give very much information to the individual, while in Swedish education, for example, the teaching is more on the same level … you teach the same content to all. (2012–04–23)

She then indicates that some may have difficulties learning mathematics. This is because

> it is nothing that you can read to be able to learn … you must have some giftedness […] in other subjects, there is always something that works or that is interesting … well, [here] one needs to have mathematical thinking. (2012–04–23)

Later in this phase, she points out that

> mathematics is more a subject that you ... [long pause] ... either you have the ability to learn mathematics or you do not have that ability ... the other subjects are something that you easily can study and learn. (2012–12–11)

Concerning this, Lisa speaks with high linguistic validity using negative polarity to emphasise her point of view. Throughout this phase, Lisa insists that

the teaching of mathematics is different from the teaching of other subjects, and because of this, Lisa is critical to the structure of the teacher education programme itself. It would be much better, Lisa argues, if they had read the mathematics education course at the very beginning of the programme instead of in the middle. This is because Lisa views the teaching of mathematics as easier than teaching other subjects. Teaching mathematics is done in a specific way, while other subjects are taught in different ways. Mathematics is what it is, and you teach mathematics in relation to that. What does it then mean when Lisa points out that a teacher should be able to teach mathematics differently in relation to each and every student?

In Lisa's view, this does not mean teaching mathematics differently, but rather it means explaining mathematics differently to different students individually. As earlier highlighted in relation to her upper primary experience and Higgins' teaching, it is essential for Lisa to have several options to explain the same mathematical phenomenon in the future. Hopefully, from Lisa's point of view, these several options will suit every student in her future classroom. A teacher has to approach students in different ways because students learn mathematics differently. It's worth bearing in mind that Lisa has emphasised her belief that mathematics is a subject that student learn individually while other subjects are learned in groups. This means that in other subjects, students can help each other more than in mathematics.

Emerging issues in this first phase

There are many emerging issues in the first phase, and my interpretation is that they all concern Lisa's engagement in a figured world of teaching and learning mathematics. I will bring up five of these. The first (1) concerns the stability of her tale and how the teaching of others fits the figured world that Lisa chooses to engage in. In relation to this, secondly (2), the role of in-class competitions as an educational strategy is highlighted. Thirdly, (3) the need for Lisa to feel successful and be acknowledged as a learner of mathematics is important to consider. The fourth (4) concerns how she discusses the prerequisite of mathematical giftedness as essential in the learning of mathematics, and finally, (5) is the issue of Lisa not referring to herself as a future teacher.

In phase one, Lisa contrasts her lower and upper primary school experiences against each other. The two main foci are the character of the material used and the role of in-class competitions as an educational strategy. In the upper primary classroom, she was successful, and in particular, she recalls a way of teaching

that foregrounds competitions and the use of a mathematics textbook. This experience is later in this phase moulded and fused in relation to the teaching of the internship supervisor, Mr Higgins. This means that the same phenomenon that is drawn into the discussion at the beginning of this phase is regenerated back into the tale later. However, her discursive patterns become differently stratified.

The individual learner is central in this phase and relates to, in my interpretation, the right to be able to show the mathematics one masters, and by this, become a part of the teaching situation. Lisa wants to be challenged mathematically, for example, completeing standard exercises quickly, and by being challenged, she experiences the situation as playful and enjoyable. A teacher should allow students to be active participants in the teaching situation but not in a collaborative way. Each student is on his or her own in the competitive classroom.

Lisa talks about being a good mathematician. There are two recognisable groups of actors in this story: one consists of those who, like Lisa, have some giftedness in mathematics and the other pertains to those who have not. Lisa talks about giftedness in relation to mathematics and that you need to view the subject as fun. In her tale, learning mathematics is an individual endeavour, and you as a student are the one who performs during lessons. What is valued here is being able to perform mathematically. Either you can, or you cannot do this. Either you are good at mathematics, or you are not.

During the one and a half years of the first phase, Lisa never talks about herself as a prospective teacher of mathematics. Instead, she talks about herself as a former student attending school. She even uses the present tense so one can interpret that she is still there in those prior classrooms when talking. Even though she uses high linguistic validity when pointing to how a future teacher should participate in the mathematics classroom, she is unable to put herself into that position. Lisa can quickly engage in conversations about teaching and learning mathematics when positioning herself and viewing these phenomena from the perspective of herself as a student attending a mathematics classroom. However, when positioning herself as a teacher or as a teacher-to-be, the same topics become complicated for her to elaborate on. Several times during this phase, we come back to the question of herself as a teacher in the future, and every time, she concludes with something like “I have not come that far”.

However, at the very end of the first phase and just before the start of the mathematics education course, concerning Higgins mathematics teaching, she concludes that "it seems difficult to engage students" (2012–12–11). This can be interpreted as a first attempt to try on the position of a teacher.

Phase 2: Developing a troublesome relationship

Phase two marks a transition period where Lisa develops a somewhat troublesome relationship to the mathematics education course. Lisa challenges her prior experience, but in this process, she develops a critical stance towards the kind of teaching that is promoted by the teacher educators. She also develops a critical stance to her fellow prospective teachers' knowledge in mathematics, arguing that most lack the knowledge required. A shift in her discursive patterns comes directly at the very beginning of the mathematics education course. Lisa slowly starts to use the language produced by the teacher educators, but in the end, she does so in order to re-negotiate back that shift to align with the figured world of performative mathematics.

While Lisa re-negotiates, she constantly mirrors the promoted teaching of the teacher educators to the figured world described in the introduction to this case. The second phase can then be understood as a phase of both change and stability. She changes her discursive patterns when enrolled in teaching situations in the mathematics education course, while at the same time, maintains her view of teaching and learning mathematics when participating in other situations that do not include teacher educators.

As pointed out in the Introduction, the mathematics education course is a 30 ECTS credits block divided into two 15 ECTS credits courses, Mathematics, and Mathematics Education I and II. These two 15 ECTS credits courses are then divided into four 7.5 ECTS credits courses that the prospective teachers attended during their teacher education. In this section, these four 7.5 ECTS credits courses are referred to as subcourses one to four. Subcourses one and two relate more to prospective teachers own mathematics than the last two subcourses.

Lisa's discursive pattern shifts in relation to in-class competitions

In this section, the first visible shift in Lisa's discursive patterns concerning in-class competitions is presented. So far in this study, Lisa has viewed competitions into the mathematics classroom as something positive for the teaching and learning of mathematics. However, when Lisa starts the course in

mathematics education, she directly begins to re-negotiate her earlier assumptions about the use of competitions when teaching. The transcript below is from the first interview conducted during the mathematics education course (2013–01–31).

Researcher You just referred to Higgins and said he awakens the competitive spirit ...

Lisa: Yes, but I think ... everyone is more or less competitive, and it is a strong firm feeling in all of us… or in me… it is [long pause] well it suits the ones who are good and not the ones who have difficulties ... so I do not know how much one will use it ... you will have to think about the pros and cons ... and then usually… well, the disadvantages take over ...

Researcher Mmm ... positive ...

Lisa Yes, but it is ... everyone concentrates more and makes every effort to get ahead ... or to win ... there will be more ... a bit more fight and quality ... sort of ... everyone concentrates more and does their best, and it helps the talented ones ... and usually, it strengthens the self-confidence ...

Researcher And ... negative ...

Lisa Well ... it ruins the confidence and quality deteriorates because it is usually timed and [as a student you should do it] as quickly as possible ... instead of as enjoyably as possible ... I think it is crucial that they compete against themselves, but I think it is difficult for students to grasp that ... you always compare with the others even if you know that it is against yourself.

The transcript above shows Lisa's shift that aligns with the new reflective experience she has gained from the mathematics course; however, it must be compared with how she engages differently when participating in other settings like study-group sessions and informal discussions at seminars where no teacher educator is present. For example, in February (field notes 2013–02–15), there is a seminar that presents different games that one can use when teaching arithmetic. Lisa attends this seminar with three other prospective teachers. The field notes from that session read:

Field notes A female prospective teacher in the group starts to discuss competitions. Two other members of the group promote that competitions are excellent (including Lisa), and yet two other group members argue against, saying they do not think competitions are an excellent teaching strategy. Those that think it is a bad idea complain that they always lost mathematics competitions as students at school. A male prospective teacher in the group says he had difficulties winning against the students on his last internship when they had competitions. At the internship, they had competitions all the time. The students had to sit on the bench and compete against each other in pairs. The winner was allowed to sit down on his/her chair again leaving the loser still sitting on the bench.

Here, in the first transcript, Lisa is present through the pronoun "I" and refers to people in general through the pronoun "one". When Lisa uses "it", it is mainly to refer to the in-class competitions as an educational strategy. The students who "have it" benefit from this way of arranging teaching, and the ones who do not are disadvantaged. However, Lisa uses the modal verb, "may", which indicates some uncertainty in relation to in-class competitions. In other terms, linguistic validity becomes low when Lisa begins to re-negotiate the role of competitions during the early stages of the mathematics education course.

Before this phase, the main focus in Lisa's tale has been competitive teaching itself. However, the functional analysis, at this point, makes visible an apparent shift in Lisa's participation in relation to the topic of competitive teaching. Lisa herself becomes more of a central character. She transforms into an agent through the personal pronoun "I". This can be viewed in the way Lisa, in the previous transcript, becomes involved for the first time through the mental process, "I think". In phase one, Lisa mainly talks about the student in the classroom and now she becomes increasingly more visible herself in the transcripts, reflecting somewhat more about teaching strategies.

The conflicting alternative story presented by the mathematics teacher educators

To understand why Lisa starts to re-negotiate her past participation, we need to enter the lecture hall and the seminar sessions that the mathematics education course provided during the first weeks of the course in mathematics education. During the lectures, several teacher educators indicated that the prospective

teachers' bad experience of mathematics teaching may be related to the fact that their past mathematics teachers used in-class competitions as an educational strategy. Given that the majority of the prospective teachers during these sessions said that they had no positive experience at all of participating in any mathematics classrooms, it became clear to Lisa that her positive experience of mathematics teaching and competitive aspects was uncommon.

One seminar was built around the prospective teachers' past participation in mathematics education, whether it be positive or negative. Several aspects of their past participation in mathematics classrooms were focused on. One example concerned the lack of communication that the prospective teachers experienced during their past mathematics lessons. In the introduction to this specific seminar, the teacher educator introduced some lesson activities that the prospective teachers attended. The teacher educator presented these activities as typical teaching activities in mathematics in relation to the curriculum documents for primary and lower secondary school. All these activities had multiple different answers. The different study groups then got an educational assignment related to these activities concerning how these activities differ from their own experience. One can see this reflected in the field notes from this session (2013–01–24):

Field notes
: On the way to the group work, Kira [one of Lisa's study-group members] says that this is different from what she expected, something different from what she had done in school. Thinking of this utterance makes me realise that the content in this seminar is distinctly different from the experience that they have from school. The prospective teachers in this group have good experience of mathematics, and they are interested and seem to know the mathematics to a higher extent than many of the others. How do they cope with this new view of teaching mathematics and that the lecturers almost paint their positive experience in black?

During this seminar, Lisa's study group points out things that they do not align with relating to the seminar questions brought up by the teacher educator. They react to utterances from the teacher educator pointing to the failure of school and that their "old" teachers and the school system contributed to the prospective teachers' "dislike" of the subject of mathematics. However, no one within this group "dislikes" the subject, but rather they love it. They like the way the subject was taught when they were students in school, and they think

this way of teaching made them all very successful in the past. Learning mathematics is an individual process, and they remember enjoying being mathematically proficient and valued for their ability in mathematise. They recall being challenged either by the mathematics textbook or competitive elements or competitive teaching strategies. Their experience made them interested in mathematics and teaching, and this is in fact the reason why they wanted to become teachers in the first place. This discussion differs from the discussions in the other study groups that I attend during this session. The rest of the study groups all intensively discuss their bad experience from past mathematics classrooms.

Before calling the groups back to the lecture hall, the seminar leader has brief discussions with each study group. Lisa's study group is the last one the teacher educator attends. The teacher educator seems stressed and starts to discuss their negative feelings against the subject without asking them about their experience. However, they do not go against the teacher educator in this discussion; they play along and have a tentative conversation aligning with the teacher educator's discussion. This deviation is brought up in the interview (2013–01–31) the week after the seminar.

Researcher I attended your group at the seminar when you had a group discussion ... and from what I perceived, you had a pretty good discussion, but then I thought, when [the teacher educator] came, all of a sudden, he started talking ...

Lisa About many things that we did not discuss.

Researcher I was wonder …

Lisa It felt a bit strange because it felt like we had done very wrong ... at the same time, it felt like we answered the questions ... and he replied ... it did not feel as if things were connected ...

Researcher I perceived it as XXX responded to something he thought you had discussed ...

Lisa mmm ... but, we had not discussed that, so it was like you had to try to keep up a little bit and pretend ... very confusing ... (laughing) ... it became ... I have a hard time understanding why he did this ... I was stunned when XXX came and discussed something else ... something else that we had not even talked about, so it was very confusing ...

Researcher I thought, when the situation arose, that you had expressed that you had quite a positive experience of school and a subject, and then he starts a discussion showing that he believed that you had not, but that was not true for you ...

Lisa Yes, it was bizarre [laughing]. But at the same time, you understand what he says, but it is not like you have considered ... often when you think back, you remember what was good ... one does not think in this way when you are young ... then everything is good, and you quickly calculated things in the mathematics textbook, and it was daaamn good ... great fun and then when he puts it ... so maybe it was not so good ... it was probably a little awakening for all ... oh ... oops ...

The main reason for Lisa's appreciation of mathematics is the way it was taught in a competitive way, and she remembers the positive feeling she had when participating in that type of classroom. However, the argumentation used by teacher educators is somewhat different. They promote another type of teaching in combination with rejecting the teaching that knowledgeable prospective teachers recall as positive. There seem to be conflicting stories about effective teaching and learning. When the prospective teachers participate in these situations, they are confused, realising that their view of good teaching is not accepted as valid within the teacher education programme.

The majority of the prospective teachers embrace the ideas presented at the mathematics education course as a revelation, and Lisa, Dina and Kira also embrace the intentions linguistically. This means that when they participate in the teacher education setting, they align their language with the language of the teacher educators. The point is that Lisa re-engages and engages in different social practices trying to balance the role of, for example, in-class competitions as an educational strategy during the mathematics education course. The manifestation of the conflict Lisa experiences can be viewed when comparing her past participation in primary school/internship to her present participation in the teacher education discourse.

Expectations on and attitudes to the teaching of the teacher educators

During Lisa's education, she builds up her expectations in relation to the mathematics education course. If one interprets the importance of the course in

mathematics education, one can say that this is the moment that Lisa has been waiting for. She has many thoughts before the start of the course:

> I think you can get much more into the mathematics ... I guess ... or I hope to get new explanations ... you might be able not to use the mathematics textbook ... sometimes [...] I do not believe the course will be very challenging mathematically ... it is not my mathematical skills that will be examined ... it is how you teach it. (2012–12–11)

Lisa then attends the course introduction (2013–01–21) of the mathematics education course. At this introduction, the prospective teachers are divided into working groups, called study groups. The different study groups are assigned to work with three questions during the last part of the introduction. Lisa and her study group are involved in an intense discussion, and they make the following summary:

1. **How much mathematics is needed by a teacher when teaching mathematics?**

A teacher needs to know more mathematics than the most knowledgeable students or at least know how to find the required information. A teacher needs to understand different ways of explaining the mathematics content that students are supposed to learn in their classroom. A teacher needs to know so much mathematics that he/she feels safe in every teaching situation.

2. **What kind of mathematics is needed and why?**

Skilled students must be challenged. Sometimes they do not get challenges themselves. Therefore, competitions become the challenge and thus the teacher needs to know the mathematics. There is no upper limit when it comes to mathematical knowledge. However, there is a lower limit that every prospective teacher needs to achieve.

3. **What are your expectations for the course in relation to your present knowledge?**

Some repetition of the mathematics that we already know and to broaden the knowledge base of the things that we already know. Foremost, we expect to develop knowledge about how to teach: “The mathematics itself… we have it under control.”

Lisa and her study group members use high linguistic validity when concluding that they are not afraid of mathematics, even though they do not know what kind of mathematics is expected during this course in mathematics education. Lisa feels comfortable in relation to mathematics and thinks that she has useful and relevant experience from school as a student and as a prospective teacher from the internship.

During the first week, Lisa attends a lot of lectures and seminars. A common theme discussed by the teacher educators in almost every situation is related to what mathematics teaching should be, as related to what it usually is and was for the prospective teachers. In the first lecture, expected future mathematics teaching is described as a social practice where the teacher visualises mathematics, listens to students, asks the right questions, considers students' knowledge and uses it in the teaching situation and supports the students who need support. In the second lecture, common misunderstandings or norms taken for granted as true about teaching mathematics is emphasised. The misunderstanding or norms are "mathematics is equivalent to calculating", "the aim with mathematics is to find the right answer" and "in the process of learning the teacher is active and the students passive" (PowerPoint from 2013–01–24). During this first week, one teacher educator refers back to the official report from the National School Inspection about the state of mathematics teaching in Sweden. In this discussion, the teacher educator urges the prospective teachers to "become the new generation of teachers, who will give all students the chance of learning and enjoying mathematics".

Lisa realises already during the first week of the course that the mathematics education courses are not set up to challenge her mathematically. It is set up to teach most of her fellow prospective teachers' the mathematics that she already knows. Later (2013–06–04), she emphasises the lack of academic challenges that she experiences in that part of the first two subcourses:

> Well, the first two was like … be there and do not do anything else beyond being there… maybe do some written assignment or whatever you were supposed to do… one did not have to get involved when doing mathematics because it felt too easy.

Immediately on the first day, Lisa and her study group begin to position themselves in opposition to the teaching at the mathematics education course. The beginning of this process can be viewed already in the field notes from 2013–01–21, the course introduction.

Field notes They talk about the management of the classroom and conclude that mathematics is different from other subjects; it is right or wrong. In other subjects, you can manage your studies in different ways. Kira laughs and says, "I know the right answer that they want, individual learning, so that it becomes relevant for every student". She uses a man's voice and sounds like an authority. Everyone laughs and Dina says, "Okay… but, what do we think?"

Lisa becomes a key participant in her group. She says she is not used to having this position, but now she feels that she can contribute a lot to the discussions. She says, "I feel a little more secure in this group… perhaps […] when you know you are right you dare to say something" (2013–01–31). Lisa thinks that her group is great and that the knowledge that they have is similar. In comparison with the whole class of prospective teachers, she emphasises that she is knowledgeable. Lisa is stunned by the fact that there are so many prospective teachers in the class who "hate mathematics" because she has always enjoyed it so much.

During one group interview (2013–03–04), Dina stresses, "I do like mathematics, and in that sense, we [Lisa, Dina and Kira] are equal ... that is ... we want to learn how to teach mathematics". Lisa thinks the same, and Dina goes on and points out that "this is the thing that I have had difficulties with ... the courses are not about learning to teach". Kira concludes in front of the group, "I did not expect that ... doing as much mathematics ourselves as we have done ... I could not believe [long pause] I did not think there would be much of that".

Dina and Lisa and the rest of their group all agree that not only have they spent a surprising amount of time on mathematics but also that the mathematics taught in the course is too easy. They feel that it all becomes extremely annoying when it takes an hour to explain simple things. As Lisa says, "Well we go through a lot of what we know already". They would have liked the course to include much mathematics, but mathematics that challenged them rather than the mathematics they already know.

As already pointed out, a specific way of talking has emerged within this study-group. When together, they talk about things that they would never say at a lecture or seminar. One of many examples of this is the following when they are talking about their future teaching in the group interview. Often, they start the conversation in the mathematics education discourse and slowly move into

another discourse, in this case, a discourse on the satisfaction of working in the mathematics textbook.

Dina	Future teaching is somewhat difficult given that we have not come very far in our education ...
Lisa	To have an open climate ... learning takes time, you know ... not that everyone sits in his place working ... like you have done yourself … but it is allowed to …
Kira	Exactly.
Lisa	Move around and work with mathematics simultaneously in some way ... you can do various such tasks ...
Kira	One is not limited as a teacher to stand at the blackboard ... and have a short lecture ...
Lisa	Or only calculating in textbooks ... it is easy to see from a perspective that it is comfortable ... you do the pages there, but at the same time ... when you read research literature ... the more you read, the more you will engage with it ...
Dina	Then it is not so bad to be bored ... then you notice when you have fun ...
Lisa	I did think it was fun to work in the textbook ...
Dina	I feel the same ...
Lisa	... to come as far in the book as possible is fun.

Depending on the situation that Lisa, Dina and Kira participate in, they engage differently. Within the social practice that evolves in relation to the mathematics education course, they all align with the ideas the teacher education programme provides them with. On the other hand, they use this social practice as a discursive counterpart when they engaging in social practices where teacher educators are not present.

Blaming the others

As presented above, Lisa liked, and still likes, the teaching that the mathematics education course has dismissed as old-fashioned. She experiences a conflict between what she sees as the priorities of the teacher education programme and

her own experiences with school mathematics and her visions of her future teaching.

When it comes to those visions of herself teaching, Lisa rarely touches upon the subject. However, she declares in the early stages of this phase that it is more probable that she will do "traditional teaching" [her wording] at the moment because it is much easier and it resembles the way that she is used to from her schooling: "Usually it will be to follow the math book to the letter ... when they are finished with it they will get something else" (2013–01–31). In the former phase of the study, Lisa classified Higgins' teaching as "new" teaching, but she realises now that it is not as "new" as she first thought. With this, she points out that the teacher educators condemn many school teachers as incompetent, urging the new prospective teachers to be the new generation of good teachers. Lisa understands that Higgins is one of those teachers being condemned; however, he is still her role model for her future teaching.

The experienced conflict between the teacher education programme and her own experiences and visions of her future teaching makes her contrast different elements of the mathematics education course against each other. Here, she even brings in her fellow prospective teachers. Some of them have been struggling hard, crying in seminars and during examinations. However, Lisa implies that she has been bored and that the teaching in relation to her standards has been too low.

During this process, Lisa starts to talk about herself as having a certain of level in mathematics, and at the same time, feeling neglected or not prioritised by the teacher educators. This can be interpreted as a consequence of what she first expected, a certain level of mathematics, a specific focus in the course, and her expectations to participate in a particular way, in relation to how the course in mathematics education then developed.

Lisa regards herself as having all the knowledge that is needed to participate in this course. She concludes during large parts of this study that her interest and giftedness in mathematics will make her a better mathematics teacher than those who are not gifted. Lisa highlights that "there is too much difference in our knowledge, it is too hard for those not handling the mathematics and too easy and boring for those that already know the mathematics." However, it is not only the differences in mathematics knowledge that is brought up concerning the others. Lisa highlights during the second half of the course that the other prospective teachers "do not put their soul into it" (2013–06–04) while Lisa's

study group works hard during the last two subcourses because they are eager to learn how to teach mathematics. In contrast, most of their fellow prospective teachers are not eager to participate in these last two courses.

Emerging issues in this second phase

Emerging issues in this phase relate to two central themes in Lisa's tale. The first concerns her argumentation and justification in relation to the transition period when Lisa develops a somewhat troublesome relationship to the mathematics education course. The second theme relates to how participation in the mathematics education course strengthens some prospective teachers' identity at the expense of the others.

The troublesome relationship to the mathematics education course can be seen when observing Lisa participating differently in settings set up by the teacher educators. She then acts and talks in "the right way", aligning with the collective endeavour of the teacher educators. However, in other social practices, she uses that experience to position her differently, and even against the teacher educators.

Lisa experiences herself as knowledgeable in mathematics. She has become that knowledgeable because of the teaching that the teacher educators openly dismiss. While obviously being a knowledgeable prospective teacher in relation to many of her fellow classmates, she starts to position herself away from the others who are not knowledgeable in mathematics. Interesting is that the kind of teaching that the teacher educators dismiss has, in her opinion, made her knowledgeable enough to manage her studies in mathematics while the others clearly fail. Lisa identifies the prospective teachers as belonging to two different groups while drawing on different social practices (for example, the teaching at teacher education) and elements from figured worlds (traditional teaching).

Phase 3: Remaining committed to the figured world

The figured world of performative mathematics that Lisa draws on from the beginning and throughout this study is once again centrally placed in her argumentation and justification. As, so far, during her entire education, the aspects that are brought into her justification falls in line with the figured world of performative mathematics. In this third phase, Lisa brings in a thinking tool that one can use when planning to teach. In her view, this thinking tool, or "model" in her words, reflects both the intentions of the teacher educators as

well as her own view of teaching. She also brings in the notion of individual specific learning styles.

During the mathematics education course, Lisa has not engaged in as many specific discussions about learning mathematics as she did before the course. However, after the course in mathematics education, she once again becomes more explicit. She emphasises that the learning of mathematics is an individual endeavour and the teaching of mathematics is related to the teachers' ability to use multiple representations to connect to the individual. In this, she may have merged prior discourses: the individual part from her early school experience and multiple representations from the teacher education course.

The course in mathematics education ends and marks a new phase

There seems to have been a tension concerning what the prospective teachers of the class have been talking about during the course in mathematics education. Lisa has aligned with the teacher educators while attending lectures and seminars, but her study group have developed a critical view of the teaching promoted by the teacher educators. However, in the last phase, Lisa does not need to align with the mathematics teacher educators anymore, and she stops referring to the teaching promoted by the educators in her argumentation and justification. This break point occurs just before the end of the mathematics education course.

Lisa points out in the last interview that was carried out while she attended the mathematics education course that she still favours competitions even though competitive mathematics is described as an insufficient teaching strategy by the teacher educators. She admits that it sounds "mean", well aware of the teaching promoted at teacher education. Lisa still argues that "everyone is competitive more or less… everyone wants to win, and no one likes to lose" (2013–06–04). She concludes the discussion about competitive teaching by emphasising that

> I do believe that competitions engage [all] students… then one [teacher] might not do it so explicitly that the student that wins gets a box of candy… but I will have competitions… not that anyone gets sad because they never win… but it is still there ... something that challenges them and makes them want to try ... and that … well … I do believe that one can involve the ones who find it easy and the ones who find it hard with mathematics … that they can applaud and encourage each other in this way … but then I do not know if competitions are the perfect kind of teaching … I do

> think that it can be important to put it into the teaching … and mathematics feels like a subject where it can be done easily. (2013–06–04)

Lisa then comes to the conclusion that she does not believe that competitions are negative for students who find mathematics difficult. She points out that competition has different potentials for all students, both those perceived as "strong" and those regarded as "weak" in mathematics. Participating in teacher education has made Lisa question competitions in teaching for a short while (phase two), but now she has concluded that it is a teaching form where every student can be encouraged and challenged. Competitive elements are now regarded as positive for all students.

Bringing in two new key concepts

During the last internship, two new notions have become visible. First, Lisa continues to elaborate on individual learning through what is known as learning styles. Secondly, she relates her teaching to a "model of teaching", MAKIS. These two concepts that all of a sudden can be regarded as key concepts in her tale were not mentioned by the educators in the course in mathematics education. One can interpret that learning styles were a part of the discussion at the first internship, but then Lisa did not use this specific notion.

Lisa emphasises directly during the second internship that students have different learning styles, and through teaching situations, they should develop their knowledge about their learning styles. The teacher educators have not discussed learning in this way. However, at the internship, they emphasise different types of learning, and one can view the resemblance to Higgins' way of talking related to the individual. This way of talking that has its foundation in different individuals' specific learning styles is here paired with the content from the mathematics education course, which is linked to multiple representations and what is known as transformations between representations.

Lisa is not that explicit in her argumentation. Therefore, she is asked to elaborate on different learning styles related to mathematics education.

> Well, one style can be that one learns through doing… for example, that you take the number line and that you move… you are yourself a number line and walk and move and another learns through looking at the number line, and that's the way that person works, and the third one must sit and draw the number line by

> oneself and put different things and someone maybe… I do not remember more at this moment… someone learns by putting numbers on the number line and some with fractions and so that it becomes visible… somewhat like that… so I believe that it is essential to find your style to know how you learn… well because if they know how they learn… if they learn to understand that, then they can adjust. (2013–11–26)

Lisa engages in the theory of learning styles. In this, teachers acknowledge that students learn in different ways and plan individual instructions in accordance with students individual learning styles. For example, a child can be a visual learner, auditory learner or a kinesthetic learner, and teachers and students act in a specific way because of students' individual styles. A visual learner should learn through being presented with pictures. As can be interpreted from the previous quotation, it is still a classroom where the teacher explains one phenomenon in many different ways.

After one of many lessons that Lisa taught at the second internship, we discuss her teaching plan. She hands over the teaching plan with pride, highlighting that the different lessons were planned after a really good model. This model was new to me and therefore became a topic in the final interview with Lisa at the end of her second internship period. The model was named MAKIS (an acronym for the Swedish translation of the terms Motivation, Activity, Concretion, Individualization and Collaboration), a concept introduced in the national curriculum from 1969, Lgr69.

Researcher But how did you get in contact with MAKIS?

Lisa I came in contact with it when we did another field assignment ... the field assignment when we observed ... then this old man had learned something in his education ... he had learned this when he did his teacher training and he thought it was great ... [yes] ... and then ... it is something ... I was caught up with it because I think it is really good ... there are so many models to follow ... you have this TPS [Think–Pair–Share], but MAKIS that's ... then you get all the mathematical representations ... it becomes concrete and individual and cooperative, and one can use it for all the representations forms to get everything into it ... [mmm] then so ... yes ...

Researcher So you felt like ...

Lisa It was like ... we did a lesson plan in a very concrete way, otherwise, it feels like it is hard to know what to do ... [mmm] but if you have a model so that you know what to involve so then you give students the possibility ... to learn in their way ... and then ... yes ... I think ...

With this "model", Lisa can apply it to two of the most important things for her: the subject of mathematics and the possibility for students to learn individually in their own way.

Lisa first encounters MAKIS during a field assignment related to the mathematics education course. The prospective teachers do several field assignments during the course in mathematics education, and they are talking amongst each other about different teaching methods and models. In this way, the various classrooms used when conducting field assignments have an influence on the way they plan their lessons during the mathematics education course. In some sense, the content and some of the activities come from teacher education itself, but the inspiration they use to arrange their teaching also comes from other places.

In Lisa's point of view, MAKIS aligns with the teaching promoted by the mathematics teacher educators and with the intentions of the newest national curriculum, Lgr 11. Lisa talks about and uses MAKIS as a model for teaching, an instructional chronology. MAKIS was not a model for lesson planning in Lgr 69, but rather it was described as a starting point, a reflection tool, for the teacher to use in relation to the planning of a lesson. MAKIS suits Lisa's view of teaching mathematics, and most importantly, she can easily fit mathematics into it. Moreover, from her point of view, it aligns well with Higgins teaching and the good experience she has from attending upper primary as a student.

Hopes for the future as a teacher by engaging in two different social practices

Lisa ends this study with high hopes for the future. We can now see (2013–11–26) how her past participation has fused and moulded with the teacher education course.

> I hope that I become a teacher that ... that varies teaching ... that means trying to find all students and teaching in a way that suits everyone, and that can adapt itself to different levels within the class ... meaning that the task is the same, but [it] functions on

> different levels so that students by themselves can choose where they are … I want to have openness within my classroom … there should be some talk and conversations and group assignments too.

In her vision of the classroom, the students are in focus and they are active. Her role is to provide the class with tasks that are adaptable, but it is up to the single student to find the right level. There are verbal processes that indicate a process of learning through talk and conversations. One can see that her future teaching is related to the way the teacher educators promoted teaching. She once again re-engages about the use of the mathematics textbook, and continues,

> …but … at the same time … they will work in the mathematics textbook also to make the parents satisfied … so that they know what happens and because I liked to work in the book, and I know that students enjoy this … the feeling of getting on with the book … this is rewarding and … they also have to play games and other stuff and talking … it is a multicultural society, and you should take care of that … so the kind of teacher I want to become is … a cool teacher and yes…

The adversative conjunction "but" indicates a contradiction. Some things seem to be said in a way that makes her thoughts align with the teacher education course, mentioning the correct way of describing her future teaching, so to speak. However, there is the real world out there, and the real world makes you act differently. During this study, Lisa has always re-engaged positively concerning the mathematics textbook. Through her own experience, she still enjoys the mathematics textbook, and she argues that her future students will probably enjoy it too. Lisa gets a comfortable feeling with the book. In a way, this is the same feeling that she had when she entered upper primary school and got her first textbook.

The final interview ends with a review over the nearly two and a half years that have passed since we met for the first time. Lisa concludes that she has got the best role model for her future, Higgins. Lisa wants to become a teacher who is just like this model. She wants to be like him. I ask her one final question.

Researcher If I, in the future, will follow another prospective teacher and this prospective teacher will talk about you as a role model. What would you want this prospective teacher to talk about?

Lisa, I want to become like Higgins … not change anything. But then, we are different people, so it will be different … I do not have all these jokes and am not that quick in my thoughts […] I think that Higgins is an excellent role model at the moment… he is, in my thoughts, a splendid teacher … he is like the teachers I liked when I was young.

Emerging issues in this third phase

In parts of this study, one can follow Lisa's struggle to stay herself, in terms of being close to the figured world of performative mathematics that she knows from her experience in school. In the mathematics education course, she is split between saying the things that she feels are expected, as in, that which correlates to the teacher educators' ideas of good teaching, and her own past experience of what has worked for her. However, in the third phase, after the end of the mathematics education course, she no longer needs to negotiate the figured world of performative mathematics that she keeps close to when talking about teaching and learning mathematics. She now focuses on finding teaching models and strategies aligning with the figured world she engages in. Individual learning styles and MAKIS are examples of such models and strategies. They both fit into her thoughts about teaching and learning mathematics. Finally, one can conclude that it is remarkable how we are back where it all begun: in the upper primary mathematics classroom and in the performative mathematics setting of individual accomplishments in competitions and with the textbook.

Significant themes emerge across the cases

Evie's and Lisa's professional developments are explained in different ways. Evie's identity development is described in four phases related to her modality – how the degree of certainty in her discursive patterns changes during her teacher education experience. In contrast to Evie, Lisa's identity development is described in three phases related to how she remains committed to the figured world of performative mathematics. However, even though their tales are different, there are some common themes across the two cases that will be elaborated in this section in relation to (1) their engagement in figured worlds, (2) their prior personal experience as learners of mathematics in different classrooms, (3) what others deem important, (4) benefiting from the experience of being different, and (5) remaining committed to their image of teaching while teacher educators promote change.

These common themes emerged in the study through the generation of data, the functional analysis, and the writing of the cases, and can be seen as themes related to similar relevant social practices and figured worlds that appear to play prominent roles within both tales.

Their engagement in figured worlds

The figured worlds of (1) performative mathematics, (2) traditional mathematics teaching and (3) reform-oriented mathematics teaching seem to be important when Evie and Lisa are developing as teachers-to-be. They use these figured worlds as intertextual building blocks in their argumentation and justification in relation to the teaching and learning of mathematics.

Figured worlds play an important role when Evie and Lisa bring in social practices from other arenas than the teacher education programme. These other past, present and imagined future social practices are what matters the most when Evie and Lisa develop as teachers-to-be. They can, for example, be conceptualised as pertaining to their prior experience of mathematics teaching and teachers from their own childhood. However, the outside experience need not have any connection to the educational sphere of school. It can be other social practices like the national soccer referee education, as in Evie's case, or being an athlete playing soccer at a high national level, as in Lisa's case.

The figured world of performative mathematics

Lisa brought in many different notions, models of teaching, and perspectives during this study. Throughout the study, one important question emerged: What patterns could be seen in these notions, models of teaching, and figured worlds? Through the work with this question, it became clear that being recognised and being able to show one's knowledge was essential for both Evie and Lisa. In this figured world, Evie became mathematically recognised as a helper and found a way of acting which she was able to perform during the mathematics education course. Lisa, on the other hand, became recognised as a winner of competitions for her computational speed and the number of textbook pages completed – experiences that became very much essential during her education.

The figured world of performative mathematics is the most important figured world for both Evie and Lisa. It's the very reason they became interested in mathematics teaching and learning. They both expect to participate in a performative environment during the mathematics education course. They expect to be challenged in this very arena, but, as we know, their expectations

were not met. The teacher education programme seems to constrain their possibility to engage in a way that interests them, but they preserve their interest that is grounded in the performative mathematics experience by remaining committed to their prior experience related to this figured world.

The figured world of traditional mathematics teaching

The figured world of traditional mathematics teaching is important for Evie's and Lisa's development as teachers-to-be. The figured world of traditional mathematics teaching corresponds to their interpretation of what society wants and expects concerning the mathematics classroom.

Evie and Lisa use this figured world in two different ways. First, they use it to promote themselves as having the right prerequisites for the profession. The expectations of society and demands on prospective teachers' knowledge guide Evie and Lisa as they both conclude, "I have what it takes to become a good teacher". In the course of Evie's and Lisa's participation in the mathematics education course, they meet other students with similar experiences, and this strengthens their identity by belonging to a group of peers. Now, they cannot only speak for themselves as individuals, but they can refer to the experience of a group: "*We* have what it takes to become good teachers." Evie and Lisa still feel legitimised by society and still regard themselves as having the right mathematical background compared to their fellow prospective teachers. Simply put, they have the ability to perform mathematics, something they consider essential for a prospective teacher.

The figured world of reform-oriented mathematics teaching

The vision of school mathematics, focusing on students' engagement in exploratory and problem-solving activities when learning mathematics is (as highlighted before) termed "reform mathematics". The content taught at the mathematics education course is aligned with the reform mathematics movement. Reform-oriented mathematics teaching and traditional mathematics teaching are continuously compared to each other in the educational setting at the university.

A very complex phenomenon can be seen in the two tales of Evie and Lisa. They both reject the teaching referred to as traditional mathematics teaching and promote "new" ways of teaching mathematics before entering the course in mathematics education. This "new" way of teaching is related to the teaching when they were most successful. They stay committed to their prior positive

experiences, which includes elements of the figured world of performative mathematics. However, even though many researchers would argue that the figured world of performative mathematics and traditional mathematics teaching are related, or even the same, they are different from Evie's and Lisa's point of view.

However, while attending the course in mathematics education, they also reject the teaching promoted by teacher educators. This teaching can be interpreted to be reform-oriented. It is important to recognise that Evie and Lisa are in opposition to parts of both the figured world of traditional mathematics teaching and the figured world of reform-oriented mathematics teaching.

Figured worlds in Evie's and Lisa's prior experiences as learners of mathematics

Evie and Lisa value different prior experiences of being in various mathematics classrooms; however, they both promote a specific kind of mathematics teaching. They re-engage as learners of mathematics to validate and then contrast these different experiences. I will exemplify this through the figured world of performative mathematics and how that figured world relates to (1) the performative culture, (2) the commitment Evie and Lisa have to a specific prior classroom, and (3) their ability to show mathematical knowledge.

Evie and Lisa describe themselves as competitive, and they refer to themselves as having been the fastest in their class during their childhood years, in terms of computational speed and in terms of the number of textbook pages completed. Both have positive memories when re-engaging in this performative culture and engage in this experience, as they recall it. However, Evie re-negotiated her view of competitive teaching environments before she entered the teacher education programme. Her mother Angela may be the reason why she re-negotiated that part of her school experience before entering teacher education. In contrast, Lisa's tale largely reflects how she tries to stay committed to the figured world of performative mathematics during her teacher education experience.

Evie and Lisa have a specific prior classroom they use when distinguishing between different learning experiences. Interestingly, but maybe not surprisingly, both promote the specific classroom in which they regarded themselves as most successful. They both use that particular classroom as a starting point in the beginning of this study. For Evie, it is the upper secondary

school classroom, and for Lisa, it is the upper primary school classroom. In these classrooms, they experienced being challenged and valued for their mathematical ability, and they felt they were able to show their mathematical knowledge.

Evie and Lisa both promote this specific prior classroom, where they were recognised as knowledgeable in mathematics. Being recognised in this way seems highly important in their imaginings of themselves in the past and present classrooms and also in their imagined future classrooms. Evie promotes a specific classroom where knowledgeable students can help other students. Later, during the mathematics education course, she becomes a "helper" of other prospective teachers who struggle with the mathematical content. By being a helper, Evie is valued as knowledgeable and gains a position in these classrooms. In Lisa's case, she interprets it as essential to be able to show one's mathematical knowledge. It seems that all argumentation and justification stem from what she missed in the lower primary classroom and what she experienced as positive in the upper primary classroom. Through the performative culture of the upper primary classroom, Lisa became recognised as someone who wins competitions, has fast computational skills, and is able to complete many textbook pages quickly.

My interpretation is that these past classrooms guide Evie's and Lisa's participation in relation to mathematics teaching and learning. They both experience that they were seen and valued in those situations for the first time and that feeling seems essential when they emerge as teachers-to-be.

What others deem important

The following section concerns a lack of recognition of the professional challenges, beyond the subject matter, that is involved in teaching. This can be viewed during the study when Evie and Lisa refer to different groups of people and forums – such as politicians, experienced teachers, and the media – as "they" or "them". Evie and Lisa both rely on what "they" say, while at the same time, they also object to central ideas of the "them" groups.

Evie and Lisa use parts of the conversations in these groups as a way of legitimising themselves as teachers-to-be. Based on the figured world of traditional mathematics teaching, in which the knowledgeable teacher is a central part, they agree to what is said by "them", whereas, on other occasions, they object to parts of the figured world, such as teacher-fronted teaching. What

can be seen here is that the figured world is an important figurative discursive arena where both Evie's and Lisa's argumentation and justification of their identity can take place. It is important to consider the characteristics of the teacher and the student, the role of the teacher and the role of the student, the way of teaching and learning, and what is valued and not valued.

By engaging in the figured world of traditional mathematics teaching, Evie and Lisa separately promote themselves as having the right prerequisites for becoming a teacher. They use the image of the knowledgeable teacher in this figured world and apply that image to themselves. Evie and Lisa feel valued for their mathematical interest and knowledge. During this study, they express confidence in themselves as having what it takes to become excellent mathematics teachers.

Nevertheless, although both Evie and Lisa engage in this figured world of traditional mathematics teaching, they only use small parts of it. They pick parts that correspond to their personal commitment. And although they are in some ways strengthened by it, Evie and Lisa mostly use the figured world of traditional mathematics teaching to manifest professional authority towards themselves and others. When used in this way, the traditional classroom is described in a negative way as a quiet place where students work at their own pace individually and where traditional teacher-fronted individual teaching is used. These parts of the figured world of traditional mathematics teaching are challenged by Evie and Lisa.

During this study, Evie and Lisa start to challenge the figured world of traditional mathematics teaching. They are disappointed in the media and the politicians that populate this figured world and object to their descriptions of teaching. Their feelings of disappointment are seen on different occasions in the study. Evie's disappointment is visible at the very beginning of the study, whereas Lisa first mentions her disappointment during her first internship. Evie and Lisa both mention that "they" (i.e. politicians, the media, society, etc.) do not valuing the teaching profession and complain about how "they" think teaching is easy. Evie and Lisa find out during their education that teaching is not easy – teaching is complex.

Benefiting from the experience of being different

Evie's and Lisa's identities, the imaginings of self in [imagined] worlds of action, as a mathematics teacher are strengthened when they compare and

contrast themselves with other prospective teachers. They benefit from the experience of being different. This can be interpreted within both cases as a process that slowly evolves during the mathematics education course. This section sets out to describe how this happens in the cases of Evie and Lisa.

During the mathematics education course, both Evie and Lisa experience general disappointment because they expected something else; they had high expectations for the course in mathematics education, and these were not met. The general disappointment relates in both cases to their fellow prospective teachers, who, in their view, lack basic knowledge in mathematics. As can be interpreted, this has consequences for Evie's and Lisa's participation in the first two subcourses. However, in subcourses 3 and 4, when Evie and Lisa think that the mathematics education courses finally become interesting, their fellow prospective teachers' will to engage in the mathematics education course decreases. This decline in interest causes Evie and Lisa to lose confidence in their fellow students. They share a feeling of being "us" against "the others".

As highlighted in the previous section, Evie and Lisa point out that they have the right mathematical background. They argue this through the figured world of traditional mathematics teaching, and they also know this by referring to what the mathematics teacher educators have indicated is the right background. At the beginning of the mathematics education course, the mathematics teacher educators show all prospective teachers the model of Mathematical Knowledge for Teaching, which in my interpretation, is a way of trying to get all prospective teachers to understand why it is essential for a prospective teacher to know the mathematics. Evie and Lisa appreciate the idea and align with the teacher educators' promotion of knowing mathematics. For them, the idea of the knowledgeable teacher promoted within the figured world of traditional mathematics teaching and by the teacher educators are the same. The discursive patterns are the same, and that is what they both bring into the mathematics education course. In this situation, Evie and Lisa are fueled with expectations, but that is soon going to change.

While Evie and Lisa appreciate the idea of Mathematical Knowledge for Teaching, most others engage in another conversation, a conversation about why one needs to know so much mathematics as an upper primary school teacher. There are two distinct positions present concerning the role that mathematics knowledge plays for teaching mathematics. Evie and Lisa position themselves squarely – and affectively – in the first, while most of their fellow students position themselves squarely – and affectively – in the other. As a

consequence, a conflict arises concerning the role mathematics play for one's future ability to teach mathematics.

Finally, during the third and fourth subcourse, Evie's and Lisa's expectations on the course in mathematics education are met. They think that the course becomes more interesting. At the same time, the other prospective teachers' will to engage in the mathematics education course decreases because they feel that they have passed "the mathematics". Here, Evie and Lisa independently start to talk more about being different. For example, they phrase the difference between themselves and the others as the difference between "we who understand mathematics" and "those who do not understand", "we who are interested in mathematics" and "those not interested in mathematics", "those who need help" and "we who don't need help", and "we who are interested in the mathematics education course" and "those not interested in the mathematics education course", et cetera.

From my point of view, more interesting is that Evie's and Lisa's experience from childhood classrooms have put them in this privileged position, while the teacher educators promote another kind of mathematics teaching than the teaching typical of their prior classrooms. Evie and Lisa benefit from their childhood experiences of being different in a positive way. These experiences give them confidence during the mathematics courses that leave them feeling neglected by the structure set up to give the other students basic mathematical training. Both feel confident that they have the right objectified meaning and the right experience and knowledge in mathematics. This puts them in a situation where they can observe others who struggle with mathematics and the mathematics education course. They use this observation to legitimise themselves as teachers-to-be.

Remaining committed to their image of teaching

During this study, Evie and Lisa try to remain committed to their prior teaching experience even though teacher educators promote certain changes in mathematics teaching.

The kind of classroom both students need to remain committed to derives from experience that they have gained outside the teacher education sphere. This was the classroom where they were most successful, something they feel most certain of. By being a "helper" of others (as in the case of Evie) and by being a student who is ahead of others (as in the case of Lisa), they both experience

being seen and valued as learners of mathematics. This feeling of being recognised is, in my interpretation, what matters the most in each tale and something that constitutes a pattern common in both tales. The figured world of performative mathematics is important and that can be seen here when both Evie and Lisa are recognised as being good at mathematics through a unified course structure where they have the opportunity to become visible. They not only perform, as described in Lisa's lower primary experience, but also they are allowed to show off their performance in different ways.

The need to remain committed to their prior classroom experiences can be followed during stages of this study when Evie and Lisa re-negotiate their imagined future teaching in relation to the teaching proposed by the mathematics teacher educators. In discussions within the teacher education programme, they partly embrace the intentions of the mathematics education course, and that can be interpreted as a way of aligning with the figured world of reform mathematics. However, outside the classroom, Evie and Lisa remain committed to the image of teaching and learning mathematics that relates to their imaginings of the teaching they experienced in the past. This has a significant impact on how Evie and Lisa re-engage and re-negotiate their past, present and imagined future mathematics teaching.

Summary

The aspects described in this section have contributed to strengthening Evie's and Lisa's identities as mathematics teachers-to-be. The tales of Evie and Lisa have illustrated how different past and present social practices and figured worlds can be used to understand the world around students who emerge into the teaching profession. It has been possible to follow the negotiation and re-negotiation of the meaning of teaching mathematics.

The different phases in the tales are critical because we can interpret how social practices and figured worlds play a role in Evie's and Lisa's tales of themselves as teachers-to-be. We can see how past and present social practices and figured worlds influence how Evie becomes the confident teacher she shows in the second internship and how her education to become a soccer referee helps her in this endeavour. We can also interpret how Lisa, in a similar way, uses a figured world throughout her education. The point is, by looking closer at the process, as done in this thesis, one can understand how, why and if students change or not. Many things happen during an education, both inside and "outside".

Discussion

This chapter includes a retrospective theoretical, methodological and empirical discussion. This retrospective discussion is divided into separate sections although I am well aware that all the parts of a study have connections between them (Gee, 2014; Skott, 2014). To retrospectively discuss the theoretical, methodological and empirical parts of a study are essential aspects of quality within interpretive research (Benton & Craib, 2011). Finally, a progressive discussion is held to gain insights for the future.

In line with Holland et al., (1998) identity, in this study, was conceptualised as "imaginings of self in [imagined] worlds of action". As humans' [prospective teachers'] immediate social interaction is fluid and dynamic (Gee, 2014), people try to understand the world around them when communicating (Holland et al., 1998; Wenger, 1998). When imagining oneself in [imagined] worlds of action, one uses stratified experience to justify the position one takes. Evie and Lisa re-engage in social practices and figured worlds (Skott, 2018) that are stratified, ordered in time and space. Considering social practices [and figured worlds] as ordered in time (Lemke, 2000) and space (Gee, 2001) allowed this study to research complex discursive patterns in multiple social practices. Social practices and figured worlds become important parts in discursive patterns.

The aim and the research questions of the study were based on this theoretical perspective. The aim was to contribute with insights about how, or even if, experience from teacher education and other relevant past and present social practices and figured worlds matter to prospective generalist teachers imaginings of themselves as primary mathematics teachers-to-be. I formulated three research questions: What engagement and re-engagement from teacher education and other relevant social practices and figured worlds were visible as

inter-textual parts in prospective teachers imaginings about themselves when developing a teacher identity? How are these different social practices and figured worlds inter-textually stratified? How do prospective teachers' patterns of participation develop during the stages of teacher education, that is, what are their patterns of patterns?

Focus on the individual

As identity can be conceptualised and researched in many different ways (Darragh, 2016), I addressed it through a participatory theoretical perspective focusing on individual prospective teachers' participation in a teacher education programme. Taking on such a perspective made it possible to re-centre, as Skott (2015) proposes, the prospective teachers in research and to follow the flow of Evie's and Lisa's activities as cross-cultural and cross-situational. The conceptual framework of Patterns of Participation allowed me to foreground the individual prospective teacher identity development during parts of the teacher education programme.

As the literature review points out, research on prospective teachers often focuses on the prospective teachers' anxiety, low mathematical knowledge and lack of interest in mathematics education. From such a perspective, research on prospective teachers tends to highlight restrictions in prospective teachers' mathematical backgrounds (Askew, 2008). This strong emphasis on restrictions has consequences for different teacher education programmes, as they then develop a therapeutic approach (Oliveira & Hannula, 2008). However, when shifting focus from the prospective teachers as anxious, having low mathematical knowledge, and no interest in mathematics education to the primary prospective teacher as engaged in mathematics, there is a need to highlight what the tales of Evie and Lisa bring to this study as critical cases. The selection of Evie and Lisa derives from the indicated research gap identified in this study. I use the term 'gap' to refer to any missing areas in the literature review, which indicates that those areas may need more attention.

Evie and Lisa as critical cases

Interestingly, prospective teachers like Evie and Lisa are not represented in research even though the research and political community promote them as important.

Evie and Lisa were chosen for several specific reasons to ensure that they were regarded as critical cases. All these reasons were connected to mathematics and mathematics education. Through the tales of Evie and Lisa, I have tried to shed light on the lack of research related to the interested and mathematically proficient primary prospect teacher. These tales are written to reflect human lived experience in accordance with the prospective teachers themselves. The specific choice of following Evie and Lisa provided this study with tension in relation to the present research literature. During this study, I have tried to justify the selection of Evie and Lisa through the indicated research gap and promote them as critical cases (Flyvbjerg, 2001).

Also, as indicated in the literature review, there is limited research about prospective primary teachers' mathematical identity development during teacher education. Two articles mention the mathematically sufficient prospective teacher. However, the case of Sirpa (Kaasila, 2007a) takes place exclusively in a teacher education setting, and she fully aligns with the intention of the teacher education programme. In my interpretation, this would probably have been the case with Evie and Lisa as well if I had not taken a theoretical approach which allows other relevant past and present social practices and figured worlds. Jong (2016), on the other hand, did not exclusively consider the teacher education programme as the only contributor to educational change, but the prospective teacher in that study, Sonja, cannot be compared on equal terms with Evie and Lisa. Although Sonja expresses a commitment towards mathematics, she was chosen by Jong because her reform-oriented approach to teaching mathematics.

Placing Evie and Lisa at the centre of attention and following their participation made it possible to ask questions about prior social practices and figured worlds, and how their stratified experience relates to other social practices and figured worlds within this network of social practices. The intention of focusing on their perspectives is to understand their experiences from their perspective. Lerman (2013) and Österholm (2011) promote Patterns of Participation to be the kind of framework that sets out to present a comprehensive view of the individual.

Reflections on the research process

This section highlights how the theoretical and methodological parts developed during this study. As a researcher, I have made certain decisions on the basis of my own experience and participation in different discursive arenas. As an

introduction to this section, I will recall three important episodes in relation to how this study evolved.

Three episodes of importance

The first episode relates to my first course as a doctoral student. This course was led by Professor Candia Morgan. During this course on social perspectives in mathematics education research, Systemic Functional Linguistics was elaborated on. It was during this time that I wrote a course paper on how Systemic Functional Linguistics and Pattern of Participation used different notions to explain similar phenomena. Professor Morgan brought the notion of stratification to my attention and said that this might be the notion that can bridge the two perspectives together in the process of research. Systemic Functional Linguistics can indicate and link stratified experience together, while Patterns of Participation sets out to describe the stratified experience indicated as cases of prospective teachers and teachers. In the process of research, Systemic Functional Linguistics also became important to me when trying to conceptualise the conceptual framework of Patterns of Participation.

The second episode relates to my supervisor, professor Jeppe Skott, when he promoted Discursive Psychology as a possible theoretical and methodological direction for this study. In the extensive reading that followed after this supervision, many interesting notions emerged, and two of them stood out as particulary relevant. The first of these was 'intertextuality' and the other was 'stratification', which confirmed the importance of this notion once again. Stratification as a phenomenon was also found in many different theoretical directions that I came across during this period. Important for this study was how Wenger (1998), Skott (2015) and Holland et al, (1998) referred to similar phenomenon. Intertextuality is a notion relating back to Bakhtin's notion of heteroglossia. Heteroglossia and stratified experience are important aspects of Holland et al.'s (1998) notion of cultural identity which is an important aspect of the Patterns of Participation framework.

The third episode relates to several supervision sessions concerning the notion of culture in ethnographic research. These occasions prompted me to read extensively about how ethnography has evolved during the last decades and how ethnography has been adapted to today's global society. Ethnographers are no longer primarily interested in colonial or local cultures, but rather they are more interested in global cultures. Global cultures are not situated in any one place – they take place in many different spaces. Global cultures are stratified

in time and space. Holland et al. (1998) draw on this phenomenon when elaborating on the notion of cultural identities.

Conceptualisation of the conceptual framework

In this study, discursive engagement in social practices and figured worlds is conceptualised as the use of stratified experience in immediate social interaction. Discursive patterns are created in discursive engagement. Such a conceptualisation positions this study closer to certain discursive directions in the research than, for example, Skott (2015) and Palmér (2013). I focus more on functionality of language or language-in-use, and I revisit the Bakhtinian element from Holland et al.'s work that has not yet been foregrounded in Patterns of Participation.

Figured worlds, or legitimate cultural worlds as real as any social practice, play a significant role in how Evie and Lisa articulate tales of themselves as teachers-to-be. These cultural worlds contribute to their discursive patterns and can be regarded as critical in the sense that they seem to discursively inform the social practice in which they participate. In line with Jong's study (2016), this study recognises figured worlds as legitimate cultural worlds that need to be recognised because engagement in social practices always seems to take place in relation to something else. This may not be a surprise if we consider Bakhtin's dialogism, that language lies on the borderline between oneself and others. Accordingly, I can focus on the phenomenon of language containing many voices – one's own and others' – that language contains variations that lead to the continual interplay of different ideas, perspectives and meanings (Holland et al,. 1998), and that "language is a plurality of relations, not just a cacophony of different voices" (Holquist, 2002, p. 89). This may not be a surprise in light of Symbolic Interactionism because one tries to take the role of others by using symbols to put oneself in another place and trying to view the world as others do (Prus, 1996).

The main point related to this is that the figured worlds about teaching and learning mathematics in this study are critical because they discursively inform every social practice that Evie and Lisa attend.

Focusing on the theoretical perspective

Gee (2011) emphasises that the chosen theoretical perspective is to guide the logic within the thesis as a sort of main criterion for the process of research. In relation to this, Patterns of Participation became a structure and thinking tool

that included predefined concepts and ideas that guided the research design. It served as justification in relation to choices made during the study. Different discursive directions, such as Critical Discourse Analysis (Fairclough, 2011), Discourse Analysis (Gee, 2011), Discursive Psychology (Potter & Wetherell, 1987) and Systemic Functional Linguistics (Halliday & Hasan, 1989), were alternative options available and have been considered during this research process. However, when the aim emerged and became more explicit, an interest in individuals' tales of themselves was foregrounded. The unique prospective of teachers' participation during the first part of the teacher education became the unit of analysis.

The main research foci included not only the discourse, interpretive repertoires or functionality of language but also the prospective teacher. Discourse analysis as theoretical and methodological constructs was not enough in this study. To merely categorise the general discourses or figured worlds was not sufficient, because such an approach could only indicate broader language structures. Therefore, instead, to understand language structures that develop as the teacher education programme develops became highly important for understanding the discursive patterns in their participation. The conceptual framework made it possible to focus on the prospective teacher attending multiple social practices and figured worlds.

The notions of intertextuality and stratification helped me to conceptualise what Skott (2015) calls re-engagement in past and present social practices and figured worlds. The notions of intertextuality and stratification gave me a language metaphor that could be used when considering the relationship between different identified social practices and figured worlds. Accordingly, I have interpreted and conceptualised the framework of Patterns of Participation to align with this specific study.

This study has contributed with a conceptual frame that captures the individual prospective teachers' past participation in social practices and figured worlds, through which the present participation in social practices has emerged. It links discursive patterns together and makes it possible to follow and describe this evolvement as shifts in participation.

Österholm (2011) highlights that studies using the conceptual framework Patterns of Participation can be read and interpreted in several ways due to various research traditions. Therefore, it seems that one can read this thesis in relation to several different perspectives. Patterns of Participation focuses on

many different social practices or figured worlds of interest in relation to the teaching and learning of mathematics, and can thereby make connections that are not normally seen in other approaches visible. In line with this, the conceptual frame helped me to keep a focus on the aim and research questions. Overall, the conceptual framework guided and influenced the design of the study from the aim to the discussion of the results in this chapter.

Methodological aspects

In relation to methodology, the conceptual framework of Patterns of Participation is described as problematic when it comes to deciding relevant social practices of interest (Österholm, 2011). In this, the ethnographic approach of multi-sited ethnography played an important role. This approach helped me to start from a wide perspective on relevant social practices during the research process and allowed me to stay focused on, as Prus (1996) emphasises, the multifaceted human lived experience from the perspectives of people. Aspers (2011) emphasises that ethnography can make processes that develop on the borderline between different social practices visible, for example, in shifted participation related to educational discursive arenas, family, leisure time activities, et cetera.

The methodological tool highlighted how language was used as a resource when prospective teachers carry out their everyday work. More specifically, Systemic Functional Linguistics highlighted inter-textual connections in discursive patterns and served this study well in relation to the framework Patterns of Participation. The combination of the chosen framework and the methodological tool allowed in-depth descriptions of complex phenomenon. This allowed creative data (Prus, 1996) that made it possible to make visible the complexity of becoming a teacher. Ethnography, Patterns of Participation and Systemic Functional Linguistics not only fit together well but also helped me to construct a deeper understanding and internal logic within this thesis.

Focusing on the results

I have tried to create two trustworthy tales – tales that can offer the reader insights, raise questions, open up discussions, make the familiar strange and maybe, hopefully, make us question our assumptions about becoming a teacher.

With Clough (2002) in mind, I have regarded quality as related to the questions that the reader encounters or does not encounter while reading the results

chapter. However, as Gee (2014) and Skott (2014) point out, quality in this kind of social research may also concern the relation between theory and methodology in terms of how they work together. The intention has been to offer results that are trustworthy to the reader by making the research process transparent. Another main concern of mine is to present the results in a way that respects Evie and Lisa.

By re-centring the prospective teacher in my research, I have focused on creating longitudinal tales of Evie and Lisa. Both students shared the same interest in mathematics and had the same educational goals and agenda in the mathematics education course. In this sense, they were alike even though their processes through the teacher education programme were different.

The main contribution and the main aim of the study

The main contribution of this study is not to give examples of the differences between the two prospective teachers but rather to add to the understanding of how the similarities of Evie's and Lisa's discursive patterns frame their processes as teachers-to-be. Through their discursive patterns, a conflict important for understanding their identity development emerges and evolves during their teacher education programme.

Despite that the teacher education community has the best of intentions, the participation in a teacher education programme is in many ways problematic. In the case of Evie and Lisa, the mathematics education course became counterproductive in many ways. The prospective teacher who finishes the teacher education programme can be regarded as the result of the education, and if one evaluates this result from the point of view of this study, one can argue that the result of the education programme becomes different from what was intended by the teacher educators. This is, of course, an important point to make, but more importantly, from my perspective, is that the teaching at the teacher education plays a significant role in creating the counterproductive result.

The study creates an understanding of how similarities between the cases are framed by the teacher education. Prospective teachers participate differently, but their discursive patterns created during the education process contain similarities. That they participate differently is quite normal because the teaching at the teacher education programme offers different discursive arenas in which the prospective teachers participate.

Teacher educators constantly offer discursive arenas that open up for different kinds of conversations. They do this because they try to adjust to the various experiences of prospective teachers while at the same time striving to create a specific kind of teacher in line with specific educational agendas. From the perspective of the teacher educators, this can be understood as a genuine concern and as an attempt to create an attachment to the prospective teacher by giving space to prior experiences and allowing various attitudes to mathematics to be expressed. This may seem very sympathetic and important, but at the same time, this allows the prospective teachers to re-negotiate the very core of the mathematics education courses, creating a shift in focus. This is how the course becomes counterproductive. By allowing the shift, the educators fail to engage the prospective teachers in the learning to teach mathematics, something that might naturally be considered the main point or the core of the mathematics courses. Prospective teachers participate in a "safe zone" when engaging in the discursive possibilities that the teacher educators offer. Importantly, this safe zone does not stimulate change but rather reinforces already existing perspectives.

An important aspect of this is that prospective teachers are not primarily challenged by encountering theoretical perspectives dealing with teaching mathematics but rather confirmed when using their prior experience as an important source when trying to determine what it means to teach mathematics. They are kept in their safe zones. When giving too much space to the prior experiences of the prospective teachers, a shift in focus arises where the mathematics education courses allow prospective teachers to deal more with the past than the future. Of course, teacher educators do put new perspectives into play and point out new directions, but teacher educators seem to be unable to follow the prospective teachers from their personal starting positions to their personal finish lines. By creating the safe zones, teacher educators allow the prospective teachers to get stuck in prior experience, indulging in it rather than participating in a transformation that is important for them as future teachers. When stuck in the safe zones, the prospective teachers end up in charge of the course, creating a shift in focus where it becomes difficult for educators to finish what they have started.

The teacher educators lose control of the content of the courses when allowing too much space for other social practices and figured worlds than those related to the intention of the mathematics education courses. The main point relates to the fact that the teacher education community provides a discursive arena that

offers each prospective teacher the possibility to engage in these counterproductive discussions. What comes from a sincere concern for the prospective teachers as individuals with various experiences of mathematics, seems to create a space where both prospective teachers and teacher educators are entangled in the past rather than the future. Does this mean that their prior experience should be abandoned, left unconsidered during the teacher education programme, or are there other alternative ways to confront prospective teachers taking poor experience into account? Most important is that prospective teachers do not stay in a negative realm of interpretation.

Teacher educators need, as Felton-Koestler (2015) proposes, to ask themselves what kind of content is vital for the prospective teachers and if and how the teacher education pays enough attention to this content. Whose perspective is represented in our teaching, and how does that relate to learning and teaching of mathematics at primary level? Focusing too much on the prior experience of the prospective teachers becomes counterproductive. Ebby (2000) concludes that the prospective teachers will benefit more from encountering educators who set up mathematical activities that stimulate them to develop new "habits of mind" so that prospective teacher can arrange, contrast and learn from different classrooms. Instead of creating a space for new and various experience, the mathematic courses seem to unintentionally focus on and preserve the classroom of the individual prospective teacher's past.

Concerns about the mathematics teacher education

In this study, I conclude that the teacher education programme does have an impact when it comes to prospective teachers' professional development, but maybe not in the way teacher educators expect or want. In this section, four matters of interest will be elaborated on in relation to the role the mathematics teacher education plays for Evie's and Lisa's development as teachers-to-be: (1) the role of discursive possibilities, (2) the goals and intentions of the teacher education versus real impact, (3) the critique of "the mathematics" in the mathematics education course, and (4) the role of internship in relation to the teacher education programme.

The role of discursive possibilities

Giddens (1984), Holland et al., (1998) and Wenger (1998) highlight that people try to understand the world by using stratified experiences in their discursive engagement. In the Results chapter, one can follow how different elements of

the teacher education, other relevant social practices, and figured worlds play a role in how Evie and Lisa articulate tales of themselves as teachers-to-be. In this process, both Evie and Lisa use language patterns from the discursive arenas that the mathematics education course provides. They draw also on stratified experience from other social practices in their lives in general discussions about teaching and learning mathematics. It is worth noting how language patterns from different social practices both from the teacher education, such as in periods of internship as well as in other outside worlds, are not reflected back into the mathematics education course itself by either of them.

An interesting phenomenon observed in this study is that the social practice changes immediately when the teacher educators leave the lecture hall. The reification of language takes on new meaning when the teacher educators are not present in the situation. My understanding is that there is a "proper" way of engaging discursively while attending the course in mathematics education that the prospective teachers both sense and pick up. When the teacher educator leaves the physical space, the functions of language shifts at once. The presence of a teacher educator seems to restrict language-in-use in particular ways. What happens if a specific social practice becomes a restricted discursive arena where past and present experience from other social practices and figured worlds are not allowed or elaborated on?

From the perspective of the pervious section, this thesis points to an interesting phenomenon. When teacher educators question and challenge the past social practices and figured worlds used by prospective teacher, these are not in the end changed, they are strengthened. It even seems that the teacher educators' questioning and challenging of Evie's and Lisa's prior perspectives on teaching make them justify their argumentation even more. When teacher educators challenge their prior experience, it does not necessarily bring about new perspectives or the kind of understanding that is desired. In my study, I can even see how prospective teachers develop a critique against the teaching promoted by the teacher educators. They use and transform the arguments the teacher educators promote to align with their imaginings of teaching rather than the reform-oriented figured worlds promoted by the teacher educators. An example of this is in the last phase, when Lisa no longer regards competitions as negative for some students. She then highlights that competition has potential for all students, both those perceived as "strong" and those regarded as "weak" in mathematics. The arguments of the prospective teacher actually seems to

become sharper when using the discursive patterns picked up from the teacher educators.

The goals and intentions of the teacher education verses real impact

During this study, Evie and Lisa clearly prioritised mathematics but not as taught in the programme. The amount of interest in mathematics seems to be a vital issue in this discussion. Evie and Lisa are indeed interested; in fact, they are even more interested than most of their fellow prospective teacher classmates. The teacher educators seem not to challenge prospective teachers in general, but more critical is that the prospective teachers who show a sincere interest in mathematics may never be challenged either. When one encounters Evie and Lisa, one may wonder why. They look forward to learning how to teach mathematics, yet the teacher educators still do not succeed in challenging them. How can teacher education be arranged so that prospective primary teachers get "really" interested in the teaching of mathematics? That is an essential question for the future in relation to the main point of this study. Based on this, research needs to look deeper into the prospective teachers' participation in the teacher education programme. Everything is not what it looks like on the surface. Prospective teachers' participation may seem to function quite well during the mathematics education course, but it can be more problematic than it appears.

Evie's and Lisa's fellow prospective teachers with negative experiences of teaching and learning mathematics seem to plunge into the teaching at teacher education. They seem to embrace the reform mathematics movement in its full complexity crying out of happiness and they shift their language in line with new ideas. What does this mean, I wonder? Are they transformed in line with the reform in the way the teacher educators want, or are they just happy because someone told them that their bad experience of mathematics was someone else's fault? In a similar way, the prospective teachers in this study with a positive experience adjust the language in relation to the mathematics education course when attending lectures and seminars. But what does this mean? Are they now on a deeper level in line with the reform, or are they, in a shallower way, simply adjusting their language to pass the course?

In the previous sections, I have discussed the immediate shift of language when teacher educators are not present, and my interpretation is that this is related to the problem that the mathematics education courses do not seem to stimulate change in the way teacher educators would like. This phenomenon is interesting

because it seems to both exclude the real experience of the prospective teachers, while at the same time, functions as a safe zone for them, giving them the "right" language to participate. My understanding is that it is important to break down or structure away this phenomenon. Through Scott's (2005) research, we already know that prospective teachers turn their educational concerns elsewhere than to the teacher educators.

In this study, I am not questioning the one-size-fit-all mentality, but rather I am questioning, like Sowder (2007), that the teacher education community seems to arrange their teaching at the teacher education programme with the background of the deficit story of prospective teachers. What I would like us to ask is if we too as teacher educators are affected by the media debate, desperately trying to win over the prospective teachers looked upon as problematic, while at the same time, resist saying that it matters whether or not teachers know mathematics.

It is clear that the teacher education programme seems to constrain Evie's and Lisa's possibility to engage in a way that interests them. Therefore, they preserve their interest grounded in the performative mathematics experience by remaining committed to their prior experience. Perhaps we need to turn things around and start off from the perspective of the core matters of learning mathematics and teaching mathematics. This might shift the focus from former experiences of failing to, instead, succeeding in previous classrooms – something that in my study seems to create barriers between groups of prospective teachers and between the prospective teachers and the teacher educators.

The critique of "the mathematics" in the mathematics education course

The figured world of performative mathematics can be recognised in the entire Results chapter (see "Results: The tales of Evie and Lisa", p.101). First concerning Evie's and Lisa's early experiences of being participants in different mathematical classrooms, and then later on during the mathematics education course, including internship. The main point in relation to the mathematics education course is that prospective teachers with "performative priorities" seem to develop a critical view both to their fellow prospective teachers and the intentions of the mathematics education course.

In relation to this, Evie and Lisa emphasise the assumption, also described in Oliveira and Hannula (2008), that prospective primary teachers are problematic. However, Evie and Lisa exclude themselves from this discussion by arguing

that they have the right prerequisites for taking on the role of a mathematics teacher. They clearly do not see themselves as problematic, and this actually creates distance between them and the mathematics education courses. It causing them to feel that the first two courses do not stimulate their learning in any way at all. Evie and Lisa describe that the teaching in the mathematics education course is for those who do not understand or are not interested in mathematics, and therefore, not for them. However, Evie and Lisa slowly start to align with the figurative understanding about primary prospective teachers' anxiety and lack of mathematical knowledge as a sort of big crisis that needs to be fixed. They slowly start to describe their fellow prospective teachers in a way that aligns with the political and media debate about prospective teachers. Their argumentation also falls in line with the "therapeutic approach", as presented in the literature review in relation to Hannula (2002) and Oliveira and Hannula (2008) even though Evie and Lisa do not use that particular notion.

Although Evie and Lisa conclude that this is the best course they have attended, they are nevertheless critical. They are critical towards the same elements as their fellow prospective teachers, however, often with the opposing view. While most prospective teachers are angry about the high demands of the mathematics knowledge needed and the focus on the performance of mathematics in examinations, Evie and Lisa think that the level of understanding that was required to pass the examinations was much too low. Often, discussions came to focus on mathematics rather than mathematics education.

In this sense, my study has some similar conclusions as the study of Beach and Player-Koro (2012). The written exams in mathematics education, as interpreted by the prospective teachers, became a critical element in a perceived "performative culture" (p. 121). This certainly draws the attention away from the actual content related to the teaching and learning of mathematics. Player-Koro (2011) describes how prospective teachers who struggled with mathematics at school continue to struggle during the teacher education programme and those who enjoyed mathematics in school continue to enjoy it while at university.

I am not questioning the intentions of the teacher educators when focusing on Mathematical Knowledge for Teaching (Ball, Hill, & Bass, 2005; Hill, Rowan, & Ball, 2005) when stressing the knowledge that prospective teachers need for teaching (Sowder, 2007). And I am not questioning at all that prospective teachers need to know important aspects of mathematics when developing as teachers-to-be. However, I fully agree with Player-Koro (2011), in that the

discursive arenas that emerge during the mathematics education course are not productive when it comes to the supposed change of the relation prospective teachers have towards mathematics teaching and learning (Rowland, Turner & Thwaites, 2014). Prospective teachers experience no significant difference between upper secondary school and teacher education. In terms of mathematics, the level of mathematics is even higher in upper secondary school than in the upper primary teacher education programme. Teacher education even ends up reproduces the way of participating in upper secondary school, and not changing it. Evie and Lisa can still assume a position of being recognised and able to show one's knowledge. We as researchers and teacher educators need to fully understand that our intentions may differ from what the prospective teachers perceive.

The role of internship in relation to the teacher education programme

As indicated in the research literature about identity development, the internship periods are greatly important (Bjuland et al., 2012; Ebby, 2000; Hodges & Hodge, 2015; Jong, 2016; Mosvold & Bjuland, 2016). Internships also became crucial for both Evie and Lisa, however, in very different ways. One can conclude that, although their experience of the first internship is very different, it sets a frame for future attendance at the mathematics education course, just not the same frame.

During this study, Evie attended two different internship schools. From Evie's own perspective, the first internship (previous to the mathematics courses) did not have an essential role for her. However, through the analysis, I understand that her first internship experience actually had a significant impact on her future education. It seemed to guide her participation in the teacher education programme. As previously shown in the Results section (see "Results: The tales of Evie and Lisa", p.101), Evie lost her sense of security during the first internship, and she had to struggle to gain back her confidence in herself as a teacher-to-be. During the second internship, Evie had regained much of her strength, this is especially due to the fact that this period followed after the mathematics education courses.

Lisa was at the same school twice and had a much smoother first internship than Evie. For Lisa, the internship was also very important. Working with her mentor and role model, Higgins, she found many possibilities to validate her past and present experiences with mathematics.

During the first and second internships, both Evie and Lisa talked about teacher education as fiction and internship as the real world. There is a risk that the teacher community, as a whole, has a figurative understanding about teacher education as not sufficient. Internship supervisors framed the teaching of the prospective teachers and provided them with the "correct" educational tools that the teacher education did not, as described in Solomon et al. (2015). As Scott (2005) emphasises, prospective teachers are more sceptical to advice from the teacher educators themselves. This is not, as already indicated, to say that teacher education does not have an impact. However, it can be interpreted that teacher educators are not the authorities they perhaps are expected to be in Evie's and Lisa's eyes.

In line with Oliveira and Hannula (2008), the analysis in this study clearly shows that Evie and Lisa use educated teachers at the internship and other settings or else family and friends instead of teacher educators when justifying their future teaching. This is interesting to consider in relation to the discussion about changing former understandings and how (and even if) the teacher education programme manifests such a change in the prospective teachers. It is perhaps most important for the future that students like Evie and Lisa have the opportunity to direct their educational concerns to the mathematics teacher educators.

Further interest

Throughout this study, Evie and Lisa demonstrated a strong and sincere commitment to learn and to develop, which would lead one to expect that they had a quite smooth ride throughout the teacher education programme. However, I conclude in this study that they had not. Evie and Lisa felt that they are wanted and prioritised by society and the mathematics teacher educators, but at the same time, they often felt neglected by the mathematics teacher educators. This creates a dissonance I would like to further study in the future: Are there hidden sections in the discursive arenas of the mathematics education course where prospective teachers like Evie and Lisa experience being pushed away? Are there other Evies and Lisas in other hidden areas who share the same experience of not being fully heard during the education? How can the social practices within teacher education programmes take steps towards discursive arenas that really function, thus bringing the prospective teacher closer to the teaching and learning of mathematics?

A forthcoming research interest relates to social practices and figured worlds and how the shared discursive arenas populated by the teacher educators and prospective teachers from different backgrounds create many experiences and can be a more inclusive place of inquiry into the phenomenon of teaching and learning mathematics. More specifically, my main interest for the future concerns the restricted discursive engagement that the social practice of lectures and seminars offer. How can teacher educators create discursive arenas where they include both those who enter the programme in utter fear of the mathematics courses as well as those who truly love mathematics? Is there a possibility of discursive arenas as safe places where the prospective teachers in a genuine way can engage in learning to teach mathematics regardless of their stratified experience, no matter what size, shape or form it has? What would the consequences of this re-negotiating of the roles of educator and prospective teacher be, in terms of identity development?

This study has contributed with insights about how experience from teacher education and other relevant past, present and imagined future social practices and figured worlds matter for prospective teachers' tales of themselves as emergent primary mathematics teachers.

Swedish summary

Denna studie fokuserar två studenter, Evie och Lisa, under de första åren av deras lärarutbildningsprogram med inriktning mot skolår 4–6 i den svenska skolan. Särskilt fokus i studien ligger på en 20-veckor lång kurs i matematikdidaktik. Studien syftar till att bidra med insikt i hur, eller till och med om, erfarenheter från ett lärarutbildningsprogram och andra relevanta sociala praktiker och så kallade figurerade världar spelar roll i blivande grundskollärares föreställningar om sig själva som lärare i matematik. Forskningsfrågor som ställs i studien är: Vilket engagemang och re-engagemang från lärarutbildningen och andra relevanta sociala praktiker och figurerade världar är synliga som intertextuella delar i blivande lärares föreställningar om sig själva när de utvecklar en läraridentitet? Hur är dessa olika sociala praktiker och figurerade världar intertextuellt stratifierade? Hur utvecklas blivande lärares deltagandemönster under delar av lärarutbildningen?

Det är allmänt accepterat att identiteter är situerade och därför multipla, eftersom de bygger på erfarenheter från flera olika områden, även utanför utbildningsområdet. Mycket få studier tar emellertid hänsyn till denna "externa" aspekt och tillåter erfarenheter från andra sociala praktiker än lärarutbildningen att bidra till beskrivningen av blivande lärares identitetsutveckling.

Denna studie begränsar sig inte till lärarutbildningen, utifrån antagandet att utbildning inte kan betraktas som enda bidragsgivare till utvecklingen av läraridentitet. Det saknas även forskning kring den grupp blivande grundskollärare som hyser ett särskilt intresse för matematik, matematikundervisning, matematikinlärning och som betraktar sig själva som kunniga och skickliga i matematik. Denna studie är därför viktig, eftersom den

illustrerar vad som ligger utanför den ”förståelsen” som vanligtvis kommer till uttryck i diskussioner kring blivande lärares deltagande i matematikdidaktiska kurser. För att få insikter om erfarenheter från lärarutbildning och andra relevanta tidigare, nuvarande och framtida sociala praktiker i relation till utvecklingen av blivande lärare, är lärarnas egna berättelser om sig själva som blivande grundskollärare viktiga. I denna studie ses lärarstudenternas egna berättelser i ljuset av olika sociala praktiker.

Teori och metodologi

Det valda teoretiska perspektiv som studien grundar sig i är Patterns of Participation, ett konceptuellt ramverk som kan användas för att tolka och beskriva lärarstudenternas professionella identitetsutveckling. Detta teoretiska perspektiv hjälper till att beskriva hur studenternas tolkning av och bidrag till social interaktion relaterar dynamiskt till det Skott (2013) benämner som tidigare engagemang i en rad andra praktiker. Fokus ligger på de pre-reifierade processer som föregår och ger upphov till vad andra forskare benämner "föreställningar/beliefs", "kunskap/knowledge" och "identitet/identity". Patterns of Participation inkluderar, eller utesluter inte, icke-matematiska och icke-institutionella erfarenheter. I min tolkning och konceptualisering av det konceptuella ramverket anses sociala praktiker vara ordnade och stratifierade över tid (Lemke, 2000) och rum (Gee, 2001). Denna studie definierar identitet som ”imaginings of self in [imagined] worlds of action” (Holland et al., 1998). Individer uttrycker föreställningar av sig själva i social interaktion och anses därmed vara dynamiska och situerade och föränderliga i tid och rum.

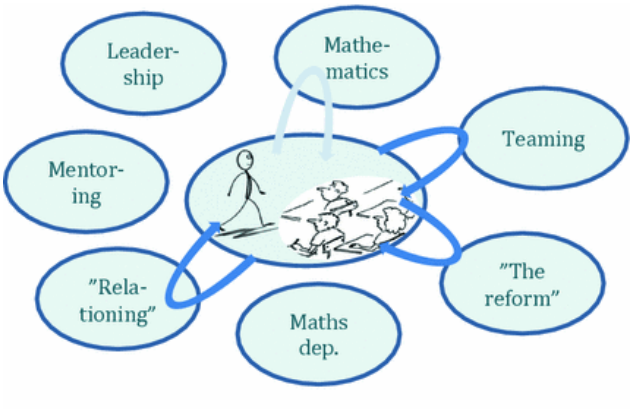

Fig 14. Skott (2018) exemplifierar hur en lärare använder olika sociala praktiker och figurerade världar i klassrumsinteraktion.

Under studiens gång har etnografiska metoder varit avgörande för att skapa empiriskt material. I det inledande skedet antogs ett brett perspektiv på många olika relevanta sociala praktiker, för att sedan övergå till att uteslutande fokusera Evies och Lisas dagliga liv under studietiden. Idag fokuserar etnografiska studier oftare "självet i praktiken" än själva praktiken i sig (Holland et al., 1998). Etnografiska forskare började i slutet på 1900-talet långsamt inkludera det som Pierides (2010) beskriver som ett multi-situerat förhållningssätt. Det är exempelvis inte bara själva klassrummet som är av specifikt intresse i en studie som denna, utan identitetsutvecklingen pågår i förhållande till flera olika sociala praktiker. Den mest betydande fördelen med denna form av etnografi är att den gör det möjligt att följa processer utanför själva lärarutbildningen och söka efter alla relevanta sociala praktiker och figurerade världar som bidrar till studenternas identitetsutveckling.

Omvandlandet av empiriskt material till datamaterial genomfördes i två steg. Först strukturerades och organiserades materialet genom att använda ett metodologiskt verktyg, Systemisk-funktionell lingvistik (SFL), som fokuserar språkets funktion i den specifika situerade situationen. Genom en funktionell analys syftar SFL till att belysa varför en talare producerar en viss formulering, snarare än någon annan, i en specifik social praktik. För denna studie erbjuder SFL en verktygslåda som möjliggör analys av betydelse på meningsnivå. Detta bidrar till att skapa förståelse för hur sociala praktiker (som undervisning i föreläsningssalen exempelvis) återspeglas i de språkliga val som deltagarna gör i olika diskursiva engagemang. För det andra användes ramverket, Patterns of Participation, vid generering av datamaterial till resultatavsnittet. I denna

process valdes relevant information som belyste specifika mönster eller diskursiva mönster i blivande lärares deltagande i sociala praktiker. Ramverket användes också senare för att producera berättelser från det genererade datamaterialet genom att koppla samman flera deltagarmönster med varandra över tid.

Resultat

I resultatdelen presenteras berättelserna om de två lärarstudenternas identitetsutveckling. I den första berättelsen står Evies upplevelse av växlande trygghet i lärarrollen i fokus och i den andra framträder Lisas premierande av matematiska prestationer utifrån en tongivande figurerad värld.

Evies identitetsutveckling beskrivs genom fyra olika faser som står i direkt relation till hennes uttryck för säkerhet i olika diskursiva engagemang under utbildningens gång. I den första fasen återberättar Evie erfarenheter av deltagande i tidigare skolrelaterade situationer. Hon ger då uttryck för hög upplevd säkerhet. Hon relaterar i hög grad till sig själv som elev i dessa klassrum, medan hon pratar om undervisning och lärande i matematik. I den andra fasen börjar Evie kontrastera sitt tidigare deltagande som elev i klassrum under den egna uppväxten med sitt deltagande som lärarstudent och lärare i mötet med framtida elever. Hon har nu fått erfarenhet av att undervisa på sin verksamhetsförlagda utbildning, VFU. Den senare upplevelsen av faktisk undervisning på praktikplatsen har konsekvenser för hennes berättelser om matematikundervisning nu och i framtiden. Evie blir osäker och visar i denna fas låg grad av säkerhet när det gäller undervisning i matematik, vilket kommer till uttryck som ett mer återhållsamt förhållningssätt. I den tredje fasen som korrelerar med matematikdidaktikens kurser på lärarutbildningen blir Evie återigen en mer aktiv och trygg deltagare i själva matematikämnet. I denna tredje fas framstår matematiklärarutbildningen bidra positivt till hennes berättelser om sig själv som blivande lärare. Hon deltar fortfarande delvis perifert i klassrummet, trots att hon känner sig bekväm med ämnet matematik. I den sista fasen blir hon en central deltagare i matematikklassrummet. Hon uttrycker med hög grad av säkerhet att hon nu är lärare på riktigt, vilket är möjligt att upptäcka genom att studera hur hon pratar om sig själv och hur hon agerar i undervisning. Värt att påpeka är att denna vunna säkerhet inte tillskrivs lärarutbildningen, utan en domarutbildning Evie har genomfört i ett idrottssammanhang som hon är engagerad i.

Lisas identitetsutveckling är en komplex berättelse som inkluderar både stabilitet och förändring. Berättelsen kännetecknas av Lisas sökande efter undervisningsstrategier som hon kan relatera till sina tidigare erfarenheter av skolmatematik. I sitt sökande efter sammanhang tar Lisa till sig många olika undervisningsstrategier och modeller relaterade till undervisning från en mängd olika sociala praktiker. Dessa olika delar passar hon in i en figurerad värld av undervisning och lärande i matematik, som hon kan relatera till ett specifikt figurativt klassrum där hon i egenskap av elev har upplevt stor framgång och glädje. Den figurerade värld Lisa engagerar sig i är ett matematikklassrum som premierar matematiska prestationer. De identifierbara karaktärerna och aktörerna i denna figurerade värld är lärare som undervisar matematik i en enhetlig kursstruktur där eleverna lär sig matematik individuellt. Aspekter som värderas är matematikkunskapen hos läraren och dennes förmåga att individualisera matematiska förklaringar i förhållande till eleverna. Viktigast av allt är elevernas förmåga att räkna matematik. I den här figurerade världen njuter eleverna i klassrummet av att vara bra på matematik.

Berättelsen om Lisa beskrivs i tre olika faser som speglar hennes nuvarande deltagande i relation till den figurerade värld som beskrivs ovan. Faserna relaterar till tre teman som är kopplade till (1) hur hennes engagemang för matematik kopplas till en bild av sig själv som en nyckelfigur för elevernas förståelse; (2) tävlingar som nyckel till produktiv och effektiv undervisning; och (3) hennes syn på matematik som ämne.

I första fasen kontrasterar Lisa olika personliga grundskoleupplevelser med varandra genom att engagera sig i den figurerade världen av ”performativ matematik”. Hon gör detta för att lyfta fram undervisningen hon upplevde på ”mellanstadiet” som en positiv erfarenhet. I detta klassrum minns hon sig själv som framgångsrik, och hon engagerar sig i ett matematikklassrum som involverar tävlingar eller prestationer i synnerhet. Senare i den här fasen formas och smälter denna erfarenhet samman med den sociala praktik där Lisas VFU-handledare deltar. Fas två som är relaterad till den matematikdidaktiska kursen ses som en övergångsperiod där Lisa utvecklar en något besvärlig relation till utbildningen. Å ena sidan utmanar hon sina tidigare erfarenheter genom nya erfarenheter från den matematikdidaktiska kursen, å andra sidan utvecklar hon i denna process en kritisk inställning till den typ av undervisning som främjas av lärarutbildarna. Lisa finner det också problematiskt att många av hennes studiekamrater saknar vad hon anser vara nödvändig baskunskap och engagemang i matematik. Den sista fasen påbörjas i slutet av den

matematikdidaktiska kursen. Även om Lisa tycker att detta har varit den bästa och mest intressanta kursen hittills i hennes lärarutbildning, accepterar hon inte lärarutbildarnas premierade sätt att undervisa matematik. Hon anpassar sig snarare till den figurerade världen av performativ matematik som lärarutbildarna inte betonar eller premierar. Vid första anblicken kan man tolka detta som en regression till den första fasen, men det är det inte. Tvärtom fortsätter Lisa att omförhandla sin syn på undervisning och lärande och tar med sig nya erfarenheter och undervisningsstrategier till sin berättelse om sig själv som blivande lärare.

Avslutning

Denna studie ökar förståelsen för diskursiva mönster hos blivande lärare i förhållande till identitetsutveckling. Evies och Lisas utvecklingsresor är knutna till deras tidigare erfarenheter av undervisning och lärande av matematik. Den figurerade världen performativ matematik är en viktig aspekt av både Evies och Lisas erfarenheter, vilket innebär att de på olika sätt i denna figurerade värld har vunnit erkännande för matematiska förmåga. Under studiens gång återkommer Evie till sig själv som en hjälpare som har kunnat klivit fram när andra har haft svårt med matematik. Hon har varit en hjälpare under hela sin skoltid och är det till och med under själva kursen i matematikdidaktik när kurskamraterna upplever studierna i matematik som betungande. Medan Evie får ett erkännande för sin matematiska kunskap i rollen som hjälpare, kan Lisas identitetsutveckling ses i förhållande till ett mer tävlingsinriktat engagemang i performativ matematik. Hon blev erkänd som en vinnare av tävlingar och för att snabbt ha slutfört läroboksövningar och det är utifrån dessa upplevelser som hon i hög grad formar sin identitetsutveckling under lärarutbildningsprogrammet.

Det centrala bidraget i denna studie är inte att ge exempel på skillnader och likheter mellan de två blivande lärarna Evie och Lisa specifikt, utan att öka förståelsen för hur figurerade världar ramar in studenters processer när de utvecklas under lärarutbildningens gång. Genom att synliggöra diskursiva mönster kan vi upptäcka figurerade världar och förstå när och hur konflikter mellan olika erfarenheter kan uppstå. Detta är viktigt i relation till lärarstudenters identitetsutveckling under ett lärarutbildningsprogram.

Lärarutbildare erbjuder ständigt olika diskursiva arenor som öppnar upp för olika slags konversationer. De gör detta för att försöka anpassa sig till de olika

erfarenheter blivande lärare har, samtidigt som de strävar efter att skapa en specifik typ av lärare i linje med specifika utbildningsagendor. Att ge utrymme för tidigare erfarenheter och låta olika attityder till matematik komma till uttryck, kan från lärarutbildarnas perspektiv förstås som en genuin vilja att möta studenterna. Detta kan förefalla sympatiskt och riktigt, men på samma gång tillåter detta förhållningssätt de blivande lärarna att förhandla om själva kärnan i matematikutbildningen, vilket skapar ett fokusskifte. Här blir kursen kontraproduktiv. Blivande lärare lämnas utrymme att bli kvar i en ”säker zon” när de deltar i de diskursiva möjligheter som lärarutbildarna erbjuder. Det är viktigt att påpeka att denna ”säkra zon” inte verkar stimulera förändringar, utan snarare förstärker redan befintliga perspektiv som lärarstudenterna har med sig från erfarenheter utanför lärarutbildningen.

I den här studien drar jag slutsatsen att lärarutbildningen har stor inverkan på blivande lärares professionella utveckling, men kanske inte på det sätt som lärarutbildarna förväntar sig eller önskar. Således skiljer sig lärarutbildarnas avsikt från resultatet. En viktig aspekt är att blivande lärare inte i tillräcklig omfattning utmanas genom att sätta sina tidigare erfarenheter i relation till de teoretiska perspektiv som är involverade i matematikundervisningen. Istället fokuseras deras tidigare erfarenhet, vilket riskerar att leda till att dessa tidigare erfarenheter, istället för de kunskapsteoretiska källorna, används som primärkällor i förhandling om vad undervisning i matematik kan vara.

References

Adler, J., Ball, D., Krainer, K., Lin, F.-L., & Novotna, J. (2005). Reflections on an emerging field: Researching mathematics teacher education. *Educational Studies in Mathematics, 60,* 359–381.

Alderson, P., & Morrow, V. (2011). *The ethics of research with children and young people: A practical handbook* (2nd ed.). London: SAGE.

Allen, G. (2000). *Inter-textuality: New critical idiom series.* New York: Routledge.

Andersson, A. (2011). *Engagement in education: Identity narratives and agency in the contexts of mathematics education*. Published doctoral thesis. Aalborg: Aalborg University, Uniprint.

Askew, M. (2008). Mathematical discipline knowledge requirements for prospective primary teachers, and the structure and teaching approaches of programmes designed to develop that knowledge. In P. Sullivan & T. Wood (Eds.), *Knowledge and beliefs in mathematics teaching and teaching development* (pp. 13–35). Rotterdam: Sense Publishers.

Aspers, P. (2011). *Etnografiska metoder: Att förstå och förklara samtiden* (2nd ed.). Malmö: Liber.

Kayi-Aydar, H. (2015). Teacher agency, positioning, and English language learners: Voices of pre-service classroom teachers. *Teaching and Teacher Education, 45,* 94–103.

Ball, D., Hill, H., & Bass, H. (2005). Knowing mathematics for teaching: Who knows mathematics well enough to teach third grade, and how can we decide? *American Educator,* 30(3), 14–46.

Ball, D., Thames, H., & Phelps, G. (2008). Content Knowledge for Teaching: What Makes It Special? *Journal of Teacher Education,* 59(5), 389–407.

Barwell, R. (2013). Discursive psychology as an alternative perspective on mathematics teacher knowledge. *ZDM – The International Journal on Mathematics Education, 45*, 595–606

Barwell, R. (2013b). Formal and informal language in mathematics classroom interaction: A dialogic perspective. In A. Lindmeier & A. Heinze (Eds.), *Proceedings of 37th conference of the International Group for the Psychology of Mathematics Education Vol. 2.* (pp. 73–80). Kiel, Germany: PME

Beach, D., Eriksson, A., & Player-Koro, C. (2011). *Changing Teacher Education in Sweden.* Paper presented at the Oxford Ethnography Conferense, Oxford.

Beach, D., & Player-Koro, C. (2012). Authoritative knowledge in initial teacher education: Studying the role of textbooks through two ethnographic studies of mathematics teacher education. *Journal of Education for teaching: International research and pedagogy, 38*, 115–125.

Benton, T., & Craib, I. (2011). *Philosophy of social science: The philosophical foundations of social thought.* Houndsmill, Basingstoke, Hampshire: Palgrave Macmillan.

Bernstein, B. (2000). *Pedagogy, symbolic control and identity: Theory, research and critique*. Maryland: Rowman and Littlefield.

Bjuland, R., Cestari, M., & Borgersen, H. (2012). Professional mathematics teacher identity: Analysis of reflective narratives from discourses and activities. *Journal of Mathematics Teacher Education, 15*, 405–424.

Björklund, J. (2011). *Lämplighetstest för blivande lärare*. http://www.regeringen.se/sb/d/14927/a/170705

Blumer, H. (1969). *Symbolic interactionism: Perspective and method*. Berkeley: University of California Press.

Bryman, A., & Nilsson, B. (2011). *Samhällsvetenskapliga metoder* (2nd ed.). Malmö: Liber.

Clough, P. (2002). *Narratives and fictions in educational research.* Buckingham: Open University Press.

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. London: SAGE.

Charmaz, K. (2008). A future for symbolic interactionism. *Studies in Symbolic Interaction, 32*, 51–59.

Chouliaraki, L., & Fairclough, N. (1999). *Discourse in late modernity: Rethinking critical discourse analysis*. Edinburgh: Edinburgh Univ. Press.

Christensen, P. (2004). Children's participation in ethnographic research: Issues of power and representation. *Children & Society,* 18, 165–176

Cooney, T. (1999). Conceptualizing teachers' ways of knowing. *Educational Studies in Mathematics, 38*, 163–187.

Darragh, L. (2016). Identity research in mathematics education. *Educational Studies in Mathematics, 93*, 19–33.

David, M. & Sutton, C.D. (2016). *Samhällsvetenskaplig metod.* (1. Uppl.) Lund: Studentlitteratur.

Delamont, S. (2008). For lust of knowing: Observation in educational ethnography. In G. Walford (Ed.), *How to do educational ethnography*. London: Tufnell Press.

Dennis, B. (2010). Ethical dilemmas in the field: The complex nature of doing education ethnography. *Ethnography and Education, 5*, 123–127.

Ebbelind, A., & Segerby, C. (2015). System functional linguistics as a methodological tool in mathematics education. *Nordic Studies in Mathematics Education, 20*,(1) 33–54.

Ebby, C. (2000). Learning to teach mathematics differently: The interaction between coursework and fieldwork for preservice teachers. *Journal of Mathematics Teacher Education, 3*, 69–97.

Eisenhart, M. (1991). Conceptual frameworks for research. In R. Underhill (Ed.), *Proceedings of the thirteenth annual meeting of the North American Chapter of the Psychology of Mathematics Education: Vol. 1.* (pp. 202–219). Blackburg, VA: Virginia Tech.

Op´t Eynde, P., Corte, E., & Verschaffel, L. (2002). Framing students' mathematics-related beliefs. In G. Leder, E. Pehkonen, & G. Törner (Eds.), *Beliefs: A hidden variable in mathematics education?* (pp. 13–37). Dordrecht: Kluwer Academic Publishers.

Fairclough, N. (1992) *Discourse and social change.* Cambridge: Polity Press.

Fairclough, N. (2010). *Critical discourse analysis: The critical study of language* (2nd ed.). Harlow: Longman.

Felton-Koestler, M. (2015). Mathematics education as socio-political: Prospective teachers' views of the What, Who, and How. *Journal of Mathematics Teacher Education*, 1–26.

Fives, H., & Buehl, M. (2011). Spring cleaning for the “messy” construct of teachers' beliefs: What are they? Which have been examined? What can they tell us? In S. Harris, T. Urdan, S. Graham, J. Royer & M. Zeidner (Eds.), *APA educational psychology handbook* (Vol. 2, pp. 471-499). Washington, DC: American Psychological Association.

Floyd, A., & Arthur, L. (2012). Researching from within: External and internal ethical engagement. *International Journal of Research & Method in Education*, 1–10.

Flyvbjerg, B. (2001). *Making social science matter: Why social inquiry fails and how it can succeed again*. Cambridge: Cambridge University Press.

Flyvbjerg, B. (2006). Five misunderstandings about case study research. *Qualitative inquiry, 12*, 219–245.

Foley, D. (2002). Critical ethnography: The reflexive turn. *International Journal of Qualitative Studies in Education, 15*, 469–490.

Forgasz, H., & Leder, G. (2008). Beliefs about mathematics and mathematics teaching. In P. Sullivan & T. Wood (Eds.), *The International Handbook of Mathematics Teacher Education* (Vol. 1, pp. 173–192). Netherlands: Sense Publishers.

Gee, P. (1999). *An introduction to discourse analysis: Theory and method*. New York: Routledge.

Gee, P. (2001). Identity as an analytic lens for research in education. *Review of Research in Education, 25*, 99–125.

Gee, J.P. (2004). *Situated language and learning.* London: Routledge.

Gee, P. (2005). *An introduction to discourse analysis: Theory and method* (2nd ed.). New York: Routledge.

Gee, P. (2011). *An introduction to discourse analysis: Theory and method* (3rd ed.). New York: Routledge.

Gee, P. (2014). *An introduction to discourse analysis: Theory and method* (4th ed.). New York: Routledge.

Gellert, U. (2000). Mathematics instruction in safe space: Prospective elementary teachers' views of mathematics education. *Journal of Mathematics Teacher Education, 3*, 251–270.

Giddens, A. (1984). *The constitution of society: outline of the theory of structuration.* Cambridge: Polity Press.

Grevholm, B. (2010). In B. Sriraman, C. Bergsten, S. Goodchild, G. Pálsdóttir, B. Dahl, & L. Haapasalo (Eds.), *The First Sourcebook on Nordic Research in Mathematics Education Norway, Sweden, Iceland, Denmark, and contributions from Finland.* Charlotte: Information Age Pub.

Gubrium, J., & Holstein, J. (2000). The Self in a World of Going Concerns. *Symbolic Interaction, 23*, 95–115.

Gubrium, J., & Holstein, J. (2009). *Analyzing Narrative Reality*. Thousand Oaks, CA: SAGE

Halliday, M. (1978). *Language as social semiotic: The social interpretation of language and meaning*. London: Edward Arnold.

Halliday, M. (2007). The notion of "context". In J. Webster (Ed.), *The Language and Education. Collected Works of M.A.K. Halliday* (Vol. 9, pp. 269–290). London and New York: Continuum.

Halliday, M., & Hasan, R. (1989). *Language, context, and text: Aspects of language in a social-semiotic perspective* (2nd ed.). Oxford: Oxford Univ Press.

Halliday, M., & Matthiessen, C. (2004). *An introduction to functional grammar* (4th ed.). London: Arnold.

Hammersley, M. (2006). Ethnography: Problems and prospects. *Ethnography and Education, 1*, 3–14.

Hannula, M. (2002). Attitude towards mathematics: Emotions, expectations and values. *Educational Studies in Mathematics, 49*, 25–46.

Halkier, B., Katz-Gerro, T., Martens, L., & Hargreaves, T. (2011). Practice-ing behaviour change: Applying social practice theory to pro-environmental behaviour change. *Journal of Consumer Culture, 11*, 79–99.

Harrison, M., & Davies, G. (1998). Lifestyles and the environment: Environment and sustainability desk study prepared for the ESRCs environment and sustainability programmeme. London: ESRC.

Hemmi, K., & Ryve, A. (2015). Effective mathematics teaching in Finnish and Swedish teacher education discourses. *Journal of Mathematics Teacher Education, 18*, 501–521.

Herbel-Eisenmann, B. (2007). From intended curriculum to written curriculum: Examining the "voice" of a mathematics textbook. *Journal for Research in Mathematics Education, 38*, 344–369.

Hermerén, G. (2011). *God forskningssed*. Stockholm: Vetenskapsrådet.

Hill, H., Rowan, B., & Ball, D. (2005). Effects of teachers' mathematical knowledge for teaching on student achievement. *American Educational Research Journal, 42*, 371–406.

Hill, H., Sleep, L., Lewis, J., & Ball, D. (2007). Assessing teachers' mathematical knowledge: What knowledge matters and what evidence counts? In F. Lester (Ed.), Handbook for Research on Mathematics Education (pp. 111–155). Charlotte, NC: Information Age Publishing.

Hodgen, J. (2011). Knowing and identity: A situated theory of mathematics knowledge in teaching. In T. Rowland & K. Ruthven (Eds.), *Mathematical Knowledge in Teaching* (pp. 27–42). Dordrecht: Springer.

Hodgen, J., & Askew, M. (2007). Emotion, identity and teacher learning: Becoming a primary mathematics teacher. *Oxford Review of Education, 33*, 469–487.

Hodges, T., & Hodge, L. (2015). Unpacking personal identities for teaching mathematics within the context of prospective teacher education. *Journal of Mathematics Teacher Education*, 1–18.

Holland, D., & Eisenhart, M. (1990). *Educated in romance: Woman, achievement, and college culture.* Chicago: University of Chicago Press

Holland, D., & Lave, J. (2009). Social practice theory and the historical production of persons. *Actio: An international Journal of Human Activity Theory, 2*, 1–15.

Holland, D., Skinner, D., Lachicotte, W., & Cain, C. (1998). *Identity and agency in cultural worlds*. Cambridge: Harvard University Press.

Holmberg, P. (2012). Kontext som aktivitet, situationstyp och praktik: En kritisk analys av kontextbegreppet i systemisk-funktionell teori. *Språk och stil, 22*, 67–86.

Holquist, M. (2002). Dialogism (2nd ed.). Abingdon: Routledge.

Horn, I. S., Nolen, S. B., Ward, C., & Campbell, S. S. (2008). Developing practices in multiple worlds: The role of identity in learning to teach. *Teacher Education Quarterly, 35*(3), 61–72.

Hošpesová, A., Carrillo, J., & Santos, L. (2018). Mathematics teacher education and professional development. In T. Dreyfus, M. Artigue, D Potari, S. Prediger & K Ruthven, K. (Eds.), *Developing Research in Mathematics Education*. (pp. 181–195) London: Routledge.

Jansson, B. (2011). *Utbildningsvetenskapens kärna: läraryrkets innersta väsen?* Malmö: Gleerup.

Jarowskij, B., & Potari, D. (2009). Bridging the macro-micro divide: Using an activity theory model to capture socio-cultural complexity in mathematics teaching and its development. *Educational Studies in Mathematics 72,* 219–236.

Jaworski, B., & Gellert, U. (2003). Educating new mathematics teachers: Integrating theory and practice, and the roles of practicing teachers. In M. Bishop, C. & J. Keitel, & F. Leung (Eds.), *Second International Handbook of Mathematics Education* (Vol. 2, pp. 829–875). Dordrecht: Kluwer Academic Publishers.

Jeffrey, B & Troman. J. (2011). The Construction of Performative Identities. *European Educational Research Journal, 10,* 484–501.

Jong, C. (2016). Linking reform-oriented experience to teacher identity: The case of an elementary mathematics teacher. *The Journal of Educational Research, 109,* 296–310.

Juter, K. (2011). *Prospective teachers' conceptions of analysis and beliefs about their impending profession.* Paper presented at the Current state of research on mathematical beliefs XVI, Tallin.

Kaasila, R. (2007a). Mathematical biography and key rhetoric. *Educational Studies in Mathematics 66,* 373–384.

Kaasila, R. (2007b). Using narrative inquiry for investigating the becoming of a mathematics teacher. *ZDM – The International Journal on Mathematics Education, 39,* 205–213.

Kaasila, R., & Lauriala, A. (2010). Towards a collaborative, interactionist model of teacher change. *Teaching and Teacher Education, 26,* 854–862.

Lave, J. (2000). Lärande, mästarlärande, social praxis. In K. Nielsen, & S. Kvale (Eds.), *Mästarlära: Lärande som social praxis (pp. 49–66).* Lund: Studentlitteratur.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge Univ. Press.

Leder, G., Pehkonen, E., & Törner, G. (2002). *Beliefs: A hidden variable in mathematics education?* Dordrecht: Kluwer Academic Publishers.

Lemke, J. L. (2000). Across the scales of time: Artifacts, activities, and meanings in ecosocial systems. *Mind, Culture and Activity, 7,* 273–290.

Lerman, S. (2000). The social turn in mathematics education research. In J. Boaler (Ed.), *Multiple Perspectives on mathematics teaching and learning* (pp. 19–44). Westport, CT: Ablex.

Lerman, S. (2002). Situating research on mathematics teachers' beliefs and on change. In G. Leder, E. Pehkonen, & G. Törner (Eds.), *Beliefs: A hidden variable in mathematics education*? (pp. 233–243). Dordrecht: Kluwer Academic Publishers.

Lerman, S. (2006). Review of ``New teacher identity and regulative government: The discursive formation of primary mathematics teacher education" Tony Brown and Olwen McNamara 2005 New York: Springer. *Journal of Mathematics Teacher Education, 9*, 299–305.

Lerman, S. (2009). Introduction, Research Forum 4: Sociological frameworks in mathematics education research. In M. Tzekaki, M. Kaldrimidou & H. Sakonidis (Eds.), *Proceedings of 33rd conference of the International Group for the Psychology of Mathematics Education: Vol. 1* (p. 217). Thessaloniki, Greece.

Lerman, S. (2013). Theories in practice: Mathematics teaching and mathematics teacher education. *ZDM – The International Journal on Mathematics Education, 45*, 623–631.

Lester, F. K. (2005). On the theoretical, conceptual, and philosophical foundations of research in mathematics education. *ZDM – The International Journal on Mathematics Education, 37*, 457–467.

Lin, F., & Ponte, J. (2008). Face-to-face learning communities of prospective mathematics teachers: Studies on their professional growth. In K. Krainer & T. Wood (Eds.), *Participants in mathematics teacher education: Individuals, teams, communities and networks* (pp. 111–129). Rotterdam: Sense Publishers.

Lijedahl, P., Oesterle, S., & Berneche, C. (2012). Stability of beliefs in mathematics education: A critical analysis. *Nordic Studies in Mathematics Education, 17*(3-4), 23–40.

Lindberg, O. (2011). Vad ska vi med lärarutbildning till? In B. Jansson (Ed.), *Utbildningsvetenskapens kärna: läraryrkets innersta väsen?* Malmö: Gleerup

LR. (2009). *Ny lärarutbildning nödvändig för kvaliteten.* Lärarnas Riksförbund: Debattartikel 2009–02–21.

LR. (2016). *Hur bra är den nya lärarutbildningen.* Lärarnas Riksförbund: https://www.lr.se/lrplay/playarkiv/hurbraardennyalararutbildningendel1.4.78ed81f8158a153980494d52.html

LT. (2012). *Lärarutbildning – Bygge i förfall.* Lärarnas Tidning: Debattartikel 2012–11–15.

Lutovac, S., & Kaasila, R. (2014). Pre-service teachers' future-oriented mathematical identity work. *Educational Studies in Mathematics, 85*, 129–142.

Ma, J. Y., & Singer-Gabella, M. (2011). Learning to teach in the Figured World of reform mathematics: negotiating new models of identity. *Journal of Teacher Education, 62*, 8–22

Macdonald, S. (2001). British Social Anthropology. In P. Athkinson; A. Coffey; S. Delamont; J. Lofland & L. Lofland. (Eds.), Handbook of ethnography (pp. 60–79). London: Sage Publications

Marcus, G. (1995). Ethnography in/of the world system: The emergence of multi-sited ethnography. *Annual Review of Anthropology, 24*, 95–117.

McAdams, D. P., & McLean, K. C. (2013). Narrative Identity. Current *Directions in Psychological Science, 22*, 233–238.

McLeod, D., & McLeod, S. (2002). Syntesis – Beliefs and mathematics education: Implications for learning, teaching, and research. In G. Leder, E. Pehkonen, & G. Törner (Eds.), *Beliefs: A hidden variable in mathematics education?* (115–123). Dordrecht: Kluwer Academic Publishers.

Mead, G. H. (1934). *Mind, self and society: From the standpoint of a social behaviorist*. Chicago: The University of Chicago Press

Morgan, C. (2006). What does social semiotics have to offer mathematics education research? *Educational Studies in Mathematics, 61*, 219–245.

Morgan, C. (2010). Making sense of curriculum innovation and mathematics teacher identity. In C. Kanes (Ed.), *Elaborating Professionalism: Studies in Practice and Theory* (pp. 107–122). Dordrecht: Springer.

Morgan, C. (2012). Studying discourse implies studying equity. In B. Herbel-Eisenmann, J. Choppin, D. Wagner, & D. Pimm (Eds.), *Equity in Discourse for Mathematics Education* (Vol. 55, pp. 181–192): Springer Netherlands.

Mosvold, R., & Bjuland, R. (2016). Positioning in identifying narratives of/about pre-service mathematics teachers in field practice. *Teaching and Teacher Education, 58*, 90–98.

Nord, A. (2013). Svårförklarlig likhet? Om kontextförståelse och journalistiska drag i reklamtexter. In S Hållsten, H Rehnberg, & D. Wojahn (Eds.), *Text, kontext och betydelse*. Stockholm: Södertörns högskola.

Oliveira, H., & Hannula, M. (2008). Individual prospective mathematics teachers. In K. Krainer & T. Wood (Eds.), *Participants in mathematics teacher education* (Vol. 3, pp. 13–34). Dordrecht: Sense Publishers.

Orr, M. (2003). *Inter-textuality: Debates and contexts*. Cambridge: Polity.

Pajares, F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research, 62*, 307–332.

Palmér, H. (2010). Identity development in limbo: Teacher transition from education to teaching. *Nordic Studies in Mathematics Education, 15*(4), 41–61.

Palmér, H. (2013). *To become – or not to become – a primary school mathematics teacher.* (Doctoral Dissertation, Linnaeus University, Sweden).

Palmér, H. (2014). Inconsistency, regression or development?: The professional identity of a novice primary school mathematics teacher. *Proceeding of MADIF 9* (107–116). Umeå.

Palmér, H. (2016). Professional primary school teacher identity development: A pursuit in line with an unexpressed image. *Teacher Development, 20*, 682–700.

Palmér, H. (2018). How to understand changes in novice mathematics teachers' talk about good mathematics teaching? *Views and Beliefs in Mathematics Education: The Role of Beliefs in the Classroom*. 127–136.

Patton, M. (2002). *Qualitative research & evaluation methods*. London: SAGE.

Petrou, M., & Goulding, M. (2011). Conceptualising teachers' mathematical knowledge in teaching. In T. Rowland & K. Ruthven (Eds.), *Mathematical knowledge in teaching* (pp. 9–25). Dordrecht: Springer Netherlands.

Philipp, A. (2007). Mathematics teachers' beliefs and affect. In F. Lester (Ed.), *Second handbook of Research on Mathematics Teaching and Learning* (pp. 257–318). Reston: National Council of Teachers of Mathematics.

Pierides, D. (2010). Multi-sited ethnography and the field of educational research. *Critical Studies in Education, 51*, 179–195.

Player-Koro, C. (2011). Marginalising students' understanding of mathematics through performative priorities: A Bernsteinian perspective. *Ethnography and Education, 6*, 325–340.

Ponte, J., & Chapman, O. (2008). Preservice mathematics teachers' knowledge and development. In L. D. English (Ed.), *Handbook of international research in mathematics education: Directions for the 21st century* (2nd ed., pp. 225–263). New York: Routledge.

Potter, J., & Wetherell, M. (1987). *Discourse and social psychology: Beyond attitudes and behaviour*. London: SAGE.

Potter, J., Wetherell, M., Gill, R., & Edwards, D. (1990). Discourse: Noun, verb or social practice. *Philosophical psychology, 3*, 205–217.

Prus, R. (1996). *Symbolic interaction and ethnographic research: Intersubjectivity and the study of human lived experience*. Albany: State Univ. of New York Press.

Rabinow, P. (1988). Beyond ethnography: Anthropology as nominalism. *Cultural Anthropology, 3*, 355–364.

Riessman, C., & Speedy, J. (2007). Narrative inquiry in the psychotherapy professions: A critical review. In D. Clandinin (Ed.), *Handbook of narrative inquiry: Mapping a methodology* (pp. 426–456). Thousand Oaks, Ca: SAGE.

Roesken, B., Pepin, B., & Toerner, G. (2011). Beliefs and beyond: Affect and the teaching and learning of mathematics. *ZDM – The International Journal on Mathematics Education, 43*, 451–455.

Rosenblatt, L.M. (2002). *Litteraturläsning som utforskning och upptäcktsresa*. Lund: Studentlitteratur.

Rowland, T. (2008). Researching teachers' mathematics disciplinary knowledge. In P. Sullivan and T. Wood (Eds.) *International handbook of mathematics teacher education: Vol.1. Knowledge and beliefs in mathematics teaching and teaching development* (pp. 273–298). Rotterdam, the Netherlands: Sense Publishers.

Rowland, T. (2013). The Knowledge Quartet: The genesis and application of a framework for analysing mathematics teaching and deepening teachers' mathematics knowledge. *Sisyphus – Journal of Education, 1*(3), 15–43.

Rowland, T., Turner, F., & Thwaites, A. (2014). Research into teacher knowledge: A stimulus for development in mathematics teacher education practice. *ZDM – The International Journal on Mathematics Education, 46*, 317–328.

Schoenfeld, A. (2007). Method. In F. Lester (Ed.), *Second Handbook of Research on Mathematics Teaching and Learning* (69–107). Reston: National Council of Teachers of Mathematics.

Schoenfeld, A. (2007b). Problem solving in the United States, 1970–2008: Research and theory, practice and politics. *ZDM – The International Journal on Mathematics Education, 39*, 537–551.

Scott, A. (2005). Pre-service teachers' experiences and the influences on their intentions for teaching primary school mathematics. *Mathematics Education Research Journal, 17*(3), 62–90.

Schwalbe, M. (1983). Language and the Self: An Expanded View from a Symbolic Interactionist Perspective. *Symbolic Interaction,6*, 291–306.

Sfard, A. (2008). *Thinking as communicating: Human development, the growth of discourses, and mathematizing*. New York: Cambridge University Press.

Sfard, A. (2009). Moving between discourses: From Learning-As-Acquisition To Learning-As-Participation. *AIP Conference Proceedings: Vol. 1179.* (pp. 55–58).

Sfard, A., & Prusak, A. (2005). Telling identities: In search of an analytic tool for investigate learning as a culturally shaped activity. *Educational Researcher, 34*(4), 14–22.

Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4–14.

Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1–22.

Skog, K. (2014). *Power, positionings and mathematics – discursive practices in mathematics teacher education: Climbing Lion's Head.* (Doctoral Dissertation, Stockholm University, Sweden).

Skog, K., & Andersson, A. (2015). Exploring positioning as an analytical tool for understanding becoming mathematics teachers' identities. *Mathematical Education Research Journal, 27,* 65–82.

Skolverket. (2011). Lgr 11 – Läroplan för grundskolan. Stockholm: Liber

Skott, J. (2001). The emerging practices of a novice teacher: The roles of his school mathematics images. *Journal of Mathematics Teacher Education, 4,* 3–28.

Skott, J. (2004). The forced autonomy of mathematics teachers. *Educational Studies in Mathematics, 55,* 227–257.

Skott, J. (2009). Contextualising the notion of `belief enactment'. *Journal of Mathematics Teacher Education, 12*, 27–46.

Skott, J. (2010). Shifting the direction of belief research: From beliefs to Patterns of Participation. In: Pinto, M. & Kawasaki, T. (Eds), *Proceedings of the 34th Conference of the International Group for the Psychology of Mathematics Education (pp.* 193–200). Belo Horizonte, Brazil: PME 34

Skott, J. (2011). *Beliefs vs. pattern of participation – towards coherence in understanding the role the teacher.* Paper presented at the Mavi 17, Ruhr-Universität Bochum.

Skott, J. (2013). Understanding the role of the teacher in emerging classroom practices: Searching for patterns of participation. *ZDM – The International Journal on Mathematics Education, 45,* 547–559.

Skott, J. (2014). *Beliefs and brownies: in search for a new identity for 'beliefs' research*. Paper presented at the Mavi 20, Falun.

Skott, J. (2015). Towards a Participatory Approach to 'Beliefs' in Mathematics Education. In B. Pepin & B. Roesken-Winter (Eds.), *From beliefs to dynamic affect systems in mathematics education: Advances in mathematics education* (3–23). Switzerland: Springer International Publishing.

Skott J. (2018). Re-centring the Individual in Participatory Accounts of Professional Identity. In: Kaiser G., Forgasz H., Graven M., Kuzniak A., Simmt E., Xu B. (eds) *Invited Lectures from the 13th International Congress on Mathematical Education. ICME-13* Monographs. Springer, Cham

Skott, J., Larsen, D., & Östergaard, C. (2011). From beliefs to patterns of participation: Shifting the research perspective on teachers. *Nordic Studies in Mathematics Education, 16,* 29–55.

Skott, J., Mosvold, R., & Sakonidis, C. (2018). Classroom practice and teachers' knowledge, beliefs and identity. In T. Dreyfus, M. Artigue, D Potari, S. Prediger & K Ruthven, K. (Eds.), *Developing Research in Mathematics Education*. (pp. 162–180) London: Routledge.

Solomon, Y., Eriksen, E., Smestad, B., Rodal, C., & Bjerke, A. (2015). Prospective teachers navigating intersecting communities of practice: Early school placement. *Journal of Mathematics Teacher Education*, 1–18.

SOU. (1999:63). *Att lära och leda*. Stockholm: Regeringen.

Sowder, J. (2007). The mathematical education and development of teachers. In F. Lester (Ed.), *Second handbook of Research on Mathematics Teaching and Learning* (pp. 257–318). Reston: National Council of Teachers of Mathematics.

Speer, N. (2005). Issues of methods and theory in the study of mathematics teachers professed and attributed beliefs. *Educational Studies in Mathematics, 58,* 361–391.

Speer, N., King, K., & Howell, H. (2015). Definitions of mathematical knowledge for teaching: Using these constructs in research on secondary and college mathematics teachers. *Journal of Mathematics Teacher Education, 18,* 105–122.

Stetsenko, A. (2008). From relational ontology to transformative activist stance on development and learning: Expanding Vygotsky's (CHAT) project. *Cultural Studies of Science Education, 3,* 471–491.

Stoehr, K. (2015). Building the wall brick by brick: One prospective teacher's experiences with mathematics anxiety. *Journal of Mathematics Teacher Education,* 1–21.

Sullivan, P., & Wood, T. (2008). *Knowledge and beliefs in mathematics teaching and teaching development*. Rotterdam: Sense.

SvD. (2010). *Tuffare krav för lärarutbildning.* SvD Nyheter, 2010–02–11.

Tatto, M.T., Lerman, S. & Novotná, J. (2009). Overview of Teacher Education Systems Across the World. In R. Even & D.L. Ball (Eds.), *The Professional Education and Development of Teachers of Mathematics. The 15th ICMI Study* (pp.15–23). NewYork: Springer.

Thompson, A. (1984). The relationship of teachers' conceptions of mathematics and mathematics teaching to instructional practice. *Educational Studies in Mathematics, 15*, 105–127.

Thompson, A. (1992). Teachers' beliefs and conceptions: A synthesis of the research. In D. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 127–146). Reston, VA: National Council of Teachers of Mathematics.

Trowler, P. (2011). Researching your own institution. *British Educational Research Association, on-line resource*.

Törner, G. (2002). Mathematical beliefs – A search for a common ground: Some theoretical considerations on structuring beliefs, some research questions, and some phenomenological observations In G. Leder, E. Pehkonen, & G. Törner (Eds.), *Beliefs: A hidden variable in mathematics education?* (pp. 73–94). Dordrecht: Kluwer Academic Publishers.

Utbildningsdepartementet. (2010). *Bäst i klassen: En ny lärarutbildning*. Stockholm: Regeringen

Utbildningsdepartementet. (2014). *Uppdrag att samordna en försöksverksamhet med krav på lämplighet vid tillträde till lärar- och förskollärarutbildning.* U2014/2222/UH Stockholm: Regeringen

Vetenskapsrådet. (1990). *Forskningsetiska principer inom humanistisk-samhällsvetenskaplig forskning.*

Walford, G. (2007). Classification and framing of interviews in ethnographic interviewing. *Ethnography and Education, 2*, 145–157.

Walford, G. (2008). The nature of educational ethnography. In G. Walford (Ed.), *How to do educational ethnography* (pp. 1–15). London: Tufnell Press.

Walford, G. (2009). The practice of writing ethnographic fieldnotes. *Ethnography and Education, 4*, 117–130.

Walshaw, M. (2004). Pre-service mathematics teaching in the context of schools: An exploration into the constitution of identity. *Journal of Mathematics Teacher Education, 7*, 63–86.

Watson, G. (1987). Make me reflexive, but not yet: Strategies for managing essential reflexivity in ethnographic discourse. *Journal of Anthropological Research, 43*, 29–41.

Watson, R. (2010). Symbolic interactionism. In J. Jaspers, J. Verschueren, & J Östman. (Eds.), *Society and language use*. Amsterdam: Benjamins.

Wenger, E. (1998). *Communities of practice: learning, meaning, and identity*. Cambridge: Cambridge University Press.

Wetherell, M. (2006). Interpretive Repertoires. In V. Jupp (Ed.), *The SAGE Dictionary of Social Research Methods* (pp. 154–156). London: SAGE

Willis, P. (1977). Learning to Labor: How working class kids get working class jobs. New York, NY: Columbia University Press.

Willis, P., & Trondman, M. (2000). Manifesto for ethnography. *Ethnography, 1*, 5–16.

Wilson, M., & Cooney, T. (2002). Mathematics Teacher Change and Development. In G. Leder, E. Pehkonen, & G. Törner (Eds.), *Beliefs: A hidden variable in mathematics education?* (pp. 127–147). Dordrecht: Kluwer Academic Publishers.

Wilson, W. J., & Anmole, C. (2009). The role of theory in ethnographic research. Ethnography, 10(4), 549–564.

Österholm, M. (2011). To translate between different perspectives in belief research: A comparison between two studies. *Nordic Studies in Mathematics Education, 16*(1–2), 57–76.

Appendix

Appendix 1 – Educational Structure

Semester 1

UVK: The history of education, its value base and social conditions, pre-school class and primary school, year 1–6, 7.5 ECTS credits [Skolväsendets historia, värdegrund och samhälleliga villkor, förskoleklass och årskurs 1–6, 7,5 hp]

UVK: Development and learning for primary teachers, 7.5 ECTS credits [Utveckling och lärande för grundlärare, 7,5 hp]

Swedish I: Swedish language and teaching in primary school years 4–6, 15 ECTS credits [Svenska språket för undervisning i årskurs 4–6, 15 hp]

Semester 2

Swedish II: Child and youth literature teaching in primary school years 4–6, 15 ECTS credits [Barn- och ungdomslitteratur för undervisning i årskurs 4–6, 15 hp]

Internship for Grades 4–6, period 1, 7.5 ECTS credits. [Verksamhetsförlagd utbildning i årskurs 4–6, period I, 7,5 hp]

UVK: Social relations, conflict management and leadership, 7.5 ECTS credits [Sociala relationer, konflikthantering och ledarskap, grundlärare, 7,5 hp]

Semester 3

Optional course 30 ECTS credits, Practical and aesthetic subjects, Nature science, Social science

Semester 4

Mathematics and mathematics education, I, for Grades 4–6, 15 ECTS credits [Matematik och matematikdidaktik I, för undervisning i årskurs 4–6, 15 hp]

Mathematics and mathematics education, II, for Grades 4–6, 15 ECTS credits [Matematik och matematikdidaktik II, för undervisning i årskurs 4–6, 15 hp]

Semester 5

UVK: Assessment and grades, 7.5 ECTS credits [Bedömning och betygsättning, grundlärare, 7,5 hp]

Internship for Grades 4–6, period II, 7.5 ECTS credits. [Verksamhetsförlagd utbildning i årskurs 4–6, period II, 7,5 hp]

UVK: Curriculum theory and methods for teaching, 7.5 ECTS credits [Läroplansteori och didaktik, grundlärare, 7,5 hp]

UVK: Special educational approach in pre-school class and primary school, for Grades 1–6, 7.5 ECTS credits [Specialpedagogiskt förhållningssätt i förskoleklass och årskurs 1–6, 7,5 hp]

Semester 6

English for teaching Grades 4–6, 30 ECTS credits [Engelska för undervisning i årskurs 4–6, 30 hp]

Semester 7

UVK: Philosophy of science and research methodology, 7.5 ECTS credits [Vetenskapsteori och forskningsmetodik, grundlärare 7,5 hp](avancerad nivå)

Independent work, 15 ECTS credits [Självständigt arbete, 15 hp]

Internship for Grades 4–6, period III, 7.5 ECTS credits. [Verksamhetsförlagd utbildning i årskurs 4–6, period III, 7,5 hp]

Semester 8

UVK: Evaluation and development, pre-school class and primary school, for Grades 1–6, 7.5 ECTS credits [Utvärdering och utvecklingsarbete, förskoleklass och årskurs 1–6, 7,5hp]

Internship for Grades 4–6, period III, 7.5 ECTS credits. [Verksamhetsförlagd utbildning i årskurs 4–6, period III, 7,5 hp]

Independent work, 15 ECTS credits [Självständigt arbete, 15 hp]

Internship for Grades 4–6, period IV, 7.5 ECTS credits. [Verksamhetsförlagd utbildning i årskurs 4–6, period IV, 7,5 hp]

Appendix 2 – Course one in mathematics education 15 ECTS credits

Linnéuniversitetet
Kalmar Växjö

Kursplan

Nämnden för utbildningsvetenskap
Institutionen för datavetenskap, fysik och matematik

2GN003 Matematik och matematikdidaktik I, för undervisning i årskurs 4-6, 15 högskolepoäng

Mathematics and mathematics education I for teaching in primary school, directed towards year 4-6, 15 credits

Huvudområde
Matematik

Ämnesgrupp
Matematik

Nivå
Grundnivå

Fördjupning
G2F

Fastställande
Fastställd av institutionsstyrelsen vid Institutionen för datavetenskap, fysik och matematik 2012-08-17

Kursplanen gäller från och med vårterminen 2013

Förkunskaper

- 1GN001 UVK-kurs: Skolväsendets historia, värdegrund och samhälleliga villkor; förskoleklass och årskurs 1-6; 7,5 hp
- 1GN003 UVK-kurs: Utveckling och lärande för grundlärare; 7,5 hp
- 1GN010 UVK-kurs: Sociala relationer, konflikthantering och ledarskap; grundlärare; 7,5 hp samt
- för inriktning mot F-3: VFU-kurs 1GN009, Verksamhetsförlagd utbildning i förskoleklass/årskurs 1-3, period 1; 7,5 hp. För inriktning mot 4-6: VFU-kurs 1GN012 Verksamhetsförlagd utbildning i årskurs 4-6 period 1; 7,5 hp.

Mål

Förväntade studieresultat gemensamma för hela kursen:

Efter avslutad kurs ska den studerande:

- kunna diskutera och redogöra för styrdokumentens roll i matematikundervisningen samt genom s k pedagogisk planering, kunna visa hur man arbetar utifrån dem i matematikundervisningen
- kunna planera, genomföra, analysera och utvärdera olika former av läraktiviteter för grundskolans 4-6 kopplat till ramverket om matematiska kompetenser
- kunna reflektera över teorier för lärande för att se sambandet mellan förmågor,

matematikinnehåll och arbetssätt i matematikundervisningen i 4-6 samt kunna tillämpa denna kunskap i praktiken för att möta och utveckla elevers förmågor och lärande
- känna till och kunna redogöra för stadierelevanta forskningsresultat från matematikdidaktik som kan relateras till matematikundervisning i grundskolans 4-6.

I övrigt gäller de förväntade studieresultaten enligt nedan.

Delkurs 1; 7,5 hp

Efter avslutad delkurs ska den studerande:

- visa fördjupade kunskaper om och på ett korrekt sätt kunna använda grundskolans matematik med fokus på aritmetik (naturliga tal, hela tal, rationella tal), tal- och rumsuppfattning, tals användning, begrepp och begreppsbildning i matematik
- kunna tillämpa kunskaper om aritmetik (naturliga tal, hela tal, rationella tal), tal- och rumsuppfattning, tals användning, begrepp och begreppsbildning i matematik, i didaktisk verksamhet med fokus på 4-6
- kunna redogöra för hur elever i årskurs F-3 utvecklar sin taluppfattning samt kunna bygga vidare på denna kunskap i verksamhet i 4-6
- kunna redogöra för hur matematiken i 4-6 ligger till grund för matematiken i 7-9 med avseende på delkursens moment
- kunna redogöra för olika faktorers inverkan på elevers lust och möjlighet att lära matematik
- kunna redogöra för samt tillämpa olika representationsformer och arbetssätt i matematik utifrån delkursens matematiska moment
- kunna redogöra övergripande för matematikämnets karaktär och idéhistoriska utveckling med avseende på delkursens matematikmoment.

Delkurs 2; 7,5 hp

Efter avslutad delkurs ska den studerande:

- visa fördjupade kunskaper om och kunna använda grundskolans matematik med fokus på geometri, algebra, statistik, sannolikhet, samband och förändring,
- kunna tillämpa kunskaper om grundskolans matematik med fokus på geometri, algebra, statistik, sannolikhet, samband och förändring i didaktisk verksamhet med fokus på 4-6,
- kunna redogöra för hur matematiken i årskurs F-3 behandlas i relation till delkursens moment samt kunna bygga vidare på denna kunskap i verksamhet i 4-6,
- kunna redogöra för hur matematiken i 4-6 ligger till grund för matematiken i 7-9 med avseende på delkursens moment,
- kunna redogöra för samt tillämpa olika representationsformer och arbetssätt i matematik utifrån delkursens matematiska moment samt
- kunna redogöra övergripande för matematikämnets karaktär och idéhistoriska utveckling med avseende på delkursens matematikmoment.

Innehåll

Delkurs 1

Delkursen behandlar studentens egna matematikkunskaper i aritmetik, med fokus på taluppfattning och tals användning, algebra samt begrepp och begreppsbildning i matematik i kombination med didaktiska perspektiv relevanta för verksamhet i årskurs 4-6. Det matematiska innehållet diskuteras i relation till de förmågor som ligger till grund för grundskolans kursplan i matematik. Dessa förmågor kopplas till matematikinnehållet och helheten belyses genom fokusering på olika arbetssätt och strategier för att stödja

taluppfattning och begreppsutveckling. Dessutom behandlas faktorer som påverkar matematikundervisning i skolan och som ger lust och möjlighet att lära matematik. Matematikens ämneskaraktär och historiska utveckling belyses i ett övergripande, orienterande skolperspektiv med fokus på matematiska tankekonstruktioner och idéer. Matematikdidaktik som forskningsfält belyses genom studier av forskningsartiklar med relevans för grundskolans matematik.

Delkurs 2
Delkursen behandlar studentens egna matematikkunskaper avseende geometri, algebra, sannolikhetslära och statistik samt samband och förändring. Dessa kunskaper fördjupas och används i kombination med didaktiska perspektiv relevanta för verksamhet i förskoleklass samt årkurs 4-6. Det matematiska innehållet diskuteras i relation till de förmågor som ligger till grund för grundskolans kursplan. Dessa förmågor kopplas till matematikinnehållet och helheten belyses genom fokusering på olika arbetssätt för att stödja begreppsutveckling och för att lyfta fram olika strategier för problemlösning med särskilt fokus på språkets roll och variation av representationsformer Dessutom behandlas faktorer som påverkar matematikundervisning i skolan och som ger lust och möjlighet att lära matematik. Matematikens ämneskaraktär och historiska utveckling belyses i ett övergripande, orienterande skolperspektiv med fokus på matematiska tankekonstruktioner och idéer. Matematikdidaktik som forskningsfält belyses genom studier av forskningsartiklar med relevans för grundskolans matematik.

Professionsbas och professionell progression
Kursen förbereder studenten för kommande VFU-period och de mål som finns formulerade för denna. Under delkursernas gång tränas studenterna i ett ämnesdidaktiskt tänkande utifrån kursinnehåll och styrdokument utifrån frågorna vad, hur och varför. Frågor kring lärarroll, lärandesituationer, stoffurval och anpassning av arbetsformer aktualiseras och behandlas vidare i samband med fältstudier.

Vetenskapligt förhållningssätt och vetenskaplig progression
Den studerande får under kursen grundläggande kunskap om ämnets och ämnesdidaktikens vetenskapliga traditioner och teoretiska begrepp. Vidare ska den studerande kunna söka forskning med relevans för ämnesområdet och för professionen. Den studerande ska, under handledning, samla in, bearbeta och göra enklare analyser av empiri och utifrån detta producera en enklare rapport med vetenskaplig disposition.

Undervisningsformer
Kursen genomförs i form av föreläsningar, seminarier, metodik pass och praktiska moment. Fältstudiedagar ingår. Undervisningens upplägg förutsätter obligatorisk närvaro på samtliga moment.

Examinationsformer
Kursen bedöms med betygen Underkänd, Godkänd eller Väl godkänd.
Kursen examineras genom aktivt deltagande vid seminarier, metodikpass och redovisningar, genom skriftliga och muntliga redovisningar av individuella uppgifter och gruppuppgifter samt genom skriftlig tentamen/hemtentamen. En del av examinationen är praktiska moment (fältstudier) som den studerande genomför och presenterar.
För att få G på kursen krävs att de förväntade studieresultaten är uppfyllda. För att få VG på hela kursen krävs VG på båda delkurserna. För studerande som ej blivit godkänd på ordinarie examinationstillfälle ges möjlighet till förnyad examination inom sex terminsveckor.

På begäran kan den studerande få sitt betyg översatt enligt ECTS-skalan. En sådan begäran skall ha inkommit till examinator före betygssättningen.

Kursvärdering
Efter avslutad kurs genomförs en kursvärdering som sammanställs skriftligt och återkopplas till studenterna. Sammanställningen redovisas för aktuella institutionsorgan och för berört programråd, samt arkiveras av kursansvarig institution.

Övrigt

Kursen ingår i grundlärarprogrammet.

Kurslitteratur och övriga läromedel

Obligatorisk kurslitteratur

Litteratur som behandlas i båda delkurserna

Ahlberg , Ann & Wallby, Karin. *Matematik från början* (senaste upplagan). Göteborg: Nationellt centrum för matematikutbildning, Univ.

Anderberg, Bengt & Källgården, Eva-Stina . *Matematik i skolan: didaktik, metodik och praktik* (senaste upplagan). Stockholm: Bengt Anderberg läromedel

Löwing, Madeleine & Kilborn, Wiggo. *Huvudräkning: en inkörsport till matematiken* (senaste upplagan). Lund: Studentlitteratur

Malmer, Gudrun. *Bra matematik för alla: nödvändig för elever med inlärningssvårigheter* (senaste upplagan). Lund: Studentlitteratur

Myndigheten för Skolutveckling. *Mer än matematik- om språkliga dimensioner i matematikuppgifter*. (46 s). www.skolverket.se/publikationer?id=1891

Sollervall, *Håkan. Tal: och de fyra räknesätten* (senaste upplagan). Lund: Studentlitteratur

Skolverket. *Läroplan för grundskolan, förskoleklassen och fritidshemmet* 2011 www.skolverket.se/publikationer?id=2575

Delkurs 1

Skolverket. Rapport 2009:5: *Undervisningen i matematik- utbildningens kvalitet och ändamålsenlighet* (28 s) www.skolinspektionen.se/Documents/Kvalitetsgranskning/Matte/granskningsrapport-matematik.pdf

Sterner, Görel & Lundberg, Ingvar. *Läs- och skrivsvårigheter och lärande i matematik* (senaste upplagan). Göteborg: Nationellt centrum för matematikutbildning, Göteborgs univ. Tillgänglig på Internet: ncm.gu.se/node/468

Delkurs 2

Hagland, Kerstin, Hedrén, Rolf & Taflin, Eva. *Rika matematiska problem: inspiration till variation* (senaste upplagan). Stockholm: Liber

Löwing, Madeleine . *Grundläggande geometri: matematikdidaktik för lärare* (senaste upplagan). Lund: Studentlitteratur

Tillkommer kompendier och vetenskapliga artiklar ca 100 s.

Appendix 3 – Course two in mathematics education 15 ECTS credits

Linnéuniversitetet
Kalmar Växjö

Kursplan

Nämnden för utbildningsvetenskap
Institutionen för datavetenskap, fysik och matematik

2GN004 Matematik och matematikdidaktik II, för undervisning i årskurs 4-6, 15 högskolepoäng

Mathematics and mathematics education II for teaching in primary school, directed towards year 4-6, 15 credits

Huvudområde
Matematik

Ämnesgrupp
Matematik

Nivå
Grundnivå

Fördjupning
G2F

Fastställande
Fastställd av institutionsstyrelsen vid Institutionen för datavetenskap, fysik och matematik 2012-08-17

Kursplanen gäller från och med vårterminen 2013

Förkunskaper

- 1GN001 UVK-kurs: Skolväsendets historia, värdegrund och samhälleliga villkor; förskoleklass och årskurs 1-6; 7,5 hp
- 1GN003 UVK-kurs: Utveckling och lärande för grundlärare; 7,5 hp
- 1GN010 UVK-kurs: Sociala relationer, konflikthantering och ledarskap; grundlärare; 7,5 hp samt
- för inriktning mot F-3: VFU-kurs 1GN009, Verksamhetsförlagd utbildning i förskoleklass/årskurs 1-3, period 1; 7,5 hp. För inriktning mot 4-6: VFU-kurs 1GN012 Verksamhetsförlagd utbildning i årskurs 4-6 period 1; 7,5 hp.
- Samt godkänd delkurs 1 om 7,5 hp från 2GN003.

Mål

Gemensamma mål för hela kursen

Efter avslutad kurs ska den studerande:

- kunna diskutera och redogöra för styrdokumentens roll i matematikundervisningen samt genom s k pedagogisk planering kunna visa hur man arbetar utifrån dem i matematikundervisningen
- kunna planera, genomföra, analysera och utvärdera olika former av läraktiviteter för grundskolans 4-6 kopplat till ramverket om matematiska kompetenser

- kunna reflektera över teorier för lärande för att se sambandet mellan förmågor, matematikinnehåll och arbetssätt i matematikundervisningen i 4-6 och kunna omsätta denna kunskap i praktiken för att möta och utveckla elevers förmågor och därigenom deras lärande
- känna till och kunna redogöra för stadierelevanta forskningsresultat från matematikdidaktik som kan relateras till matematikundervisning i grundskolans 4-6.

I övrigt gäller målen enligt nedan.

Delkurs 1; 7,5 hp
Efter avslutad delkurs ska den studerande:

- kunna analysera matematikuppgifter avseende syfte, innehåll, förkunskaper, lösningsstrategier och kritiska aspekter i elevens lärande,
- kunna tolka mål och betygskriterier för matematik i grundskolans F-6, med tyngdpunkt på 4-6 och deras implikationer för undervisning och bedömning av elevprestationer,
- kunna analysera uppgifter, elevlösningar och läromedel samt konstruera uppgifter och prov utifrån mål för lärande samt
- kunna kartlägga, dokumentera och bedöma elevers kunskaper samt kunna analysera elevers kunskapsutveckling i matematik.

Delkurs 2; 7,5 hp
Efter avslutad delkurs ska den studerande:

- kunna redogöra för hur olika elevers matematiska förmåga avseende begrepp, representation, problemlösning, kommunikation och resonemang kan ta sig uttryck i olika matematikinnehåll, med tyngdpunkt på innehållet i åk 4-6,
- visa kunskap om och i enkla tillämpningsövningar visa hur matematiska förmågor kan utvecklas genom variationer i innehåll och arbetssätt samt
- visa fördjupad förmåga att använda olika lärandemiljöer och metoder, inklusive IKT, för att stödja och utmana alla elevers lärande i matematik.

Innehåll

Delkurs 1
Kursen inleds med fördjupning avseende styrdokument, speciellt mål och betygskriterier för grundskolans matematik med tonvikt på 4-6, som utgångspunkt för att förstå grundskolans specifika villkor och praktik. De egna matematikkunskaperna från 2GN003 utvecklas vidare genom att dels lösa uppgifter och dels konstruera egna uppgifter utifrån ett givet matematikinnehåll. Med utgångspunkt i den egna matematiken samt matematik för 4-6 behandlar delkursen studier och analys av elevers lösningar av matematikuppgifter, läromedelsanalys samt analys av matematikuppgifter med avseende på syfte, innehåll, matematiska förkunskaper och utvecklingsbara lösningsstrategier Analys av elevlösningar och matematikuppgifter innefattar kartläggning och bedömning som grund för dokumentation av elevens kunskap och som stöd för elevens fortsatta kunskapsutveckling. Kartläggning, bedömning och betygssättning av elevers kunskap i matematik behandlas utifrån fördjupad förståelse av sambandet mellan förmågor och matematikinnehåll och i förhållande till aktuella mål.

Delkurs 2
Kursen syftar till att fördjupa studenternas förmåga att anpassa innehåll och arbetssätt för att kunna möta, utmana och utveckla alla elevers matematiska förmågor, där även ett specialpedagogiskt perspektiv (individ, grupp, organisation) lyfts fram. Matematikundervisning som fenomen behandlas utifrån olika klassrumsperspektiv (t.ex. elev, lärare, kommunikation, demokrati, motivation, genus, etnicitet) och fördjupas genom studier av vetenskapliga artiklar.

Professionsbas och professionell progression
Kursen förbereder studenten för kommande VFU-period och de mål som finns formulerade för denna. Frågor kring lärarroll, lärandesituationer, stoffurval och anpassning av arbetsformer från kursen 2GN003 fördjupas och behandlas vidare i samband med fältstudier. Fokus ligger på hur ämnesinnehåll och undervisning kan anpassas till elevers skilda förutsättningar samt hur dokumentation och bedömning av eleveras kunskaper i ämnet kan gå till.

Vetenskapligt förhållningssätt och vetenskaplig progression
Den studerande får under kursen fördjupad kunskap om ämnets och ämnesdidaktikens vetenskapliga traditioner och teoretiska begrepp. Vidare ska den studerande kunna söka forskning med relevans för ämnesområdet och för professionen. Den studerande ska kunna förstå och hantera olika forskningsmetoder (observation, intervju och enkät) samt under handledning samla in, bearbeta och göra enklare analyser av empiri och utifrån detta producera en enklare rapport med vetenskaplig disposition.

Undervisningsformer
Kursen genomförs i form av föreläsningar, seminarier, metodik pass och praktiska moment. Fältstudiedagar ingår. Undervisningens upplägg förutsätter obligatorisk närvaro på samtliga moment.

Examinationsformer
Kursen bedöms med betygen Underkänd, Godkänd eller Väl godkänd.
Kursen examineras genom aktivt deltagande vid seminarier, metodikpass och redovisningar, genom skriftliga och muntliga redovisningar av individuella uppgifter och gruppuppgifter samt genom skriftlig tentamen/hemtentamen. En del av examinationen är praktiska moment (fältstudier) som den studerande genomför och presenterar.
För att få G på kursen krävs att de förväntade studieresultaten är uppfyllda. För att få VG på hela kursen krävs VG på båda delkurserna. För studerande som ej blivit godkänd på ordinarie examinationstillfälle ges möjlighet till förnyad examination inom sex terminsveckor.

På begäran kan den studerande få sitt betyg översatt enligt ECTS-skalan. En sådan begäran skall ha inkommit till examinator före betygssättningen.

Kursvärdering
Efter avslutad kurs genomförs en kursvärdering som sammanställs skriftligt och återkopplas till studenterna. Sammanställningen redovisas för aktuella institutionsorgan och för berört programråd, samt arkiveras av kursansvarig institution.

Övrigt
Kursen ingår i grundlärarprogrammet.

Kurslitteratur och övriga läromedel
Obligatorisk kurslitteratur
Litteratur som behandlas i båda delkurserna

McIntosh, Alistair. *Förstå och använda tal: en handbook* (senaste upplagan). Göteborg: Nationellt centrum för matematikundervisning (NMC), Göteborgs universitet

Malmer, Gudrun. *Bra matematik för alla: nödvändig för elever med inlärningssvårigheter* (senaste upplagan). Lund: Studentlitteratur

Skolverket. *Läroplan för grundskolan, förskoleklassen och fritidshemmet*, 2011 www.skolverket.se/publikationer?id=2575

Delkurs 1
Pettersson, Astrid. *Bedömning av kunskap: för lärande och undervisning i matematik* (senaste upplagan). Stockholm: Institutionen för matematikämnets och naturvetenskapsämnenas didaktik, Stockholms universitet

Analysschema i matematik för åren före skolår 6 / Lärarhögskolan i Stockholm. PRIM-gruppen. (senaste upplagan). Stockholm: Skolverket
Länkadress: www.skolverket.se/publikationer?id=2219

Delkurs 2
Jess, Kristine, Skott, Jeppe & Hansen, Hans Christian. *Matematik för lärare. My, Elever med särskilda behov* (senaste upplagan). Malmö: Gleerups

Myndigheten för Skolutveckling. *Mer än matematik- om språkliga dimensioner i matematikuppgifter*. www.skolverket.se/publikationer?id=1891 (46 s).

Mönks, Franz J. - *Att se och möta begåvade barn : [en vägledning för lärare och föräldrar]* / Franz J. Mönks, Irene H. Ypenburg (senaste upplagan). Natur och Kultur.

Sterner, Görel & Lundberg, Ingvar. *Läs- och skrivsvårigheter och lärande i matematik* (senaste upplagan). Göteborg: Nationellt centrum för matematikutbildning, Göteborgs universitet. Tillgänglig på Internet: ncm.gu.se/node/468

Rystedt, Elisabeth & Trygg, Lena. *Laborativ matematikundervisning: vad vet vi?* (senaste upplagan). Göteborg: Nationellt centrum för matematikutbildning, Göteborgs universitet. Tillgänglig på Internet:
ncm.gu.se/media/ncm/dokument/laborativ_mat_und.pdf

Tillkommer kompendier och vetenskapliga artiklar ca 100s.

Appendix 4 – Initial interview

Inledning: Under den inledande delen av samtalet berörs återigen forskningens syfte och vad som förväntas av deltagarna.
Även frågan om varför man valt att söka till utbildningen kommer in under denna del.

- Varför bli lärare, varför valt åldrarna 4–6?

Inledande frågor/teman:

- Kan du ge något exempel på en riktigt bra lärare i matematik som du haft under din skoltid?
    - Vad gjorde den läraren som var bra?
- Kan du ge något exempel på en lärare i matematik som inte var bra?
    - Vad var det som gjorde att den läraren inte var bra?
- Vad gör då att en undervisningssituation i matematik blir riktigt bra?
- När du tänker på dig själv som lärare, hur tänker du då?
    - Vad tror du kommer bli svårt?
    - Vad ser du fram emot?
    - Hur ser du på att undervisa i matematik kontra andra ämnen?
    - Vilka är skillnaderna i sättet att undervisa?
- Vad är viktigt att tänka på när man undervisar i matematik?
- Vilka ämnen tycker du verkar mest intressanta att undervisa i?

Egna erfarenheter av matematik:

- Om vi tar dina egna erfarenheter av matematik, vad skulle du säga då?
- Hur framställer media och familj ditt kommande yrke?
    - Undervisning i matematik?
    - Om du får tolka politikerna idag, hur tror du att de vill att det ser ut i klassrummen?

Matematik isig:

- Vad är matematik?
- Vad skiljer matematik från andra ämnen?
- Om du får beskriva en matematiker, hur är han då?

Appendix 5 – Follow-up questions

Intervjuguide: Stöd inför intervju verksamhetsförlagda utbildningen.

Inledning:

- Berätta för mig… hur har tiden som gått varit…
- Vad är det som du tar med dig?
- Hur tänker du om ditt yrkesval idag?

Inledande frågor/teman:

- Hur skulle du beskriva skolan du har hamnat på?
- Skolans kultur?
- Tillåtande klimat?
- Vilka är de grundläggande värderingar som du känner att handledaren förmedla till dig?
- Hur sker denna återkoppling?
- Kan du lyfta fram saker som handledaren gör riktigt bra?
- Något som du skulle gjort annorlunda?
- Vad är kriterierna för att vara en riktig lärare, vad är din målbild?

Inledande frågor/teman:

- Vad innebär det att undervisa matematik?
- Hur lär man sig matematik?
- Frågor om framtiden.

Ev, matematik isig:

- Vad är viktigt när man undervisar matematik?