

SCHOOL-BASED MATHEMATICS TEACHER EDUCATION IN SWEDEN AND FINLAND: CHARACTERIZING MENTOR-PROSPECTIVE TEACHER DISCOURSE

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Despite many similarities between the neighbouring countries Sweden and Finland, prior studies indicate that conceptualizations and discourses about school-based teacher education are very different. In this paper we add to this picture of differences, and contribute to the research discourse about school-based teacher education, by identifying and characterizing aspects of mathematics teaching made relevant in review meetings between mentors and prospective primary teachers. While the Swedish discourse typically focuses on the students' individual work with textbooks, connections to everyday experiences and teaching as individual supervision, the Finnish discourse emphasizes lesson aims, learning and progression in mathematics through formative assessment and differentiation according to pupils' abilities.

Keywords: Comparative study; Finland, school-based teacher education, Sweden.

INTRODUCTION

To become, and develop as, a mathematics teacher can be seen as a lifelong socialization process, initiated in school and teacher training and continued throughout one's entire professional life. There are many different aspects of this process worth studying, and multiple ways of describing and conceptualizing it (Adler, Ball, Krainer, Lin, & Novotna, 2005). Through this process the teacher should, for instance, develop necessary knowledge in and about mathematics, a number of competencies and teaching skills, as well as a productive teacher identity within a teacher community. A substantial number of studies have engaged in these areas (see, e.g., Jaworski & Gellert, 2003; Rowland & Ruthven, 2011; Rowland, Turner, Thwaites, & Huckstep, 2009; Sowder, 2007).

Whatever perspective one adopts, it seems reasonable to assume that university-based teacher education alone cannot provide teachers with the very specialized and complex competencies needed for productively teaching mathematics and acting as a mathematics teacher. Such competencies must be continually developed through years of critical reflection over one's own teaching practice (e.g., Adler & Davis, 2006). However, research indicates that if deliberately designed, such a critical attitude towards teaching can be fostered in teacher training programs (Rowland & Ruthven, 2011; Rowland, et al., 2009). School-based parts of pre-service teacher education may have a crucial role to play when it comes to creating opportunities for the prospective teachers (PTs) to experience and reflect upon the complexities of mathematics teaching together with mentors (Jaworski & Watson, 1994). Ideally, in such situations, qualified and experienced teachers serve as important guides in

socializing the PTs into ways of becoming, and thinking like, a critically reflected teacher (Hegender, 2010; Jaworski & Gellert, 2003). Although school-based teacher education (SBTE) in mathematics has been suggested as an important instance for developing as a teacher (e.g., Frykholm, 1999), the opportunities created for developing competencies in teaching mathematics within this practice cannot be taken for granted. For instance, while several studies (e.g., Ebby, 2000; Krzywacki-Vainio & Hannula, 2008) show that PTs regard the SBTE as the most important element of their education, “too often school experiences, particularly student teaching, are disconnected from university-based components of teacher preparation” (Sowder, 2007, p. 202).

In understanding more about SBTE and the opportunities created for PTs to develop as competent mathematics teachers in such practices, we find the cases of Sweden and Finland of interest to study. Despite many similarities between Sweden and Finland concerning the school system, prior studies indicate that conceptualizations and discourses about SBTE in the countries are very different (Ryve, Hemmi, & Börjesson, 2011) and we are beginning to collect evidence that there are substantial differences between the countries concerning curriculum materials (Hemmi, Koljonen, Hoelgaard, Ahl, & Ryve, 2012) and classroom teaching (Andrews, Ryve, & Hemmi, 2012; Hemmi & Ryve, 2012). In this paper we are particularly interested in characterizing the discourse, where discourse is defined as a recurrent way of communicating (Ryve, 2011), between mentors and prospective primary school teachers (PTs) after classroom lessons in which PTs have taught. We aim at characterizing such meetings by engaging in the research question: *Which kinds of aspects of teaching practice are made relevant in the discourses and how are phenomena related to mathematics teaching construed?*

METHODOLOGY

This paper is situated within the principle that language use can be seen not only as a reflection of reality but also as a tool for constituting reality (e.g., Sfard, 2008; Säljö, 2000). Data were collected in the form of audio-recordings from ten review meetings between mentors and PTs in Sweden and six in Finland. The meetings took place immediately after a mathematics lesson that a researcher had attended and made field notes of or videotaped. The researcher was also present at the meeting, but took a passive role. Common for all PTs in are that they are attending their second (of four) period of SBTE. In our Finnish cases the prospective teachers conduct their SBTE in pairs and hence are two prospective teachers present in the review meetings from Finland. During the Swedish meetings no university lecturer was present, and this relates to fact that during the whole eight-week SBTE period no university lecturer visited the PTs. In contrast, in Finland, university lecturers were present, and took an active role, during two of the analysed meetings. Further, in the Finnish cases the SBTE is conducted at a university practice school where mentors have several hours per week for developing their mentoring. In Sweden the SBTE is organised in ordinary schools where teachers have limited time for mentoring. This means that the

review meetings had different conditions and this reflects a structural difference between the two countries.

In this paper we present the initial analysis of four meetings that we have transcribed so far from each country and this will guide us when analysing the rest of the data. The analysis uses an iterative approach going through several cycles. We used NVivo as a facilitating tool, and all four authors contributed to interpretations of the data. The Swedish transcripts were first analysed by two research team members and the Finnish transcripts were analysed by the Finnish speaking member of the team. We had no explicit categories when we conducted the first analysis but we were searching for aspects made relevant.

We checked each other's analysis and agreed on the following categories that we had derived from the data: *Lesson aims, Learning and progression in mathematics, Differentiation and individualization, Mathematics and its connections to everyday experiences, Assessment, Classroom management, Mathematics textbooks and Resource constraints.*

We decided also to attempt to describe how the role of the teacher, pupil, mentor and PT is conceptualized in the discourses. We then analysed the data once more using all the categories and finally, compared the categories in both countries. When we are referring to the Swedish and Finnish discourses we are only expressing the characteristics of the discussions we have analysed and do not attempt to generalize cross-national differences.

RESULTS

The results section is structured in such a way that all recurrent themes of aspects made relevant within the union of Swedish and Finnish discourse are presented in order to make the comparison of the discourses of the countries transparent. (SWE M1) refers to a Swedish mentor in Group 1 and (FIN PT12) refers to PT one in the second group in Finland. A university lecturer in mathematics education is represented by U.

Lesson aims

The Finnish discourse is typically anchored in relation to the written lesson plans and the PTs' teaching. For example, the mentors point out the importance of making the aims of the lesson clear to the children by writing a proper headline on the board. Lesson aims also become relevant in relation to issues about pupils' mathematical knowledge and progression as well as the assessment of pupils. Hence, the aims of the lessons are both made relevant and explicit through the lesson plans and stressed as important to make explicit for the pupils in the classroom.

The Swedish discourse contains no explicit statements about formal learning goals for the lessons, or about the outcome in relation to such goals. On a few occasions, these two matters are implicitly included through questions such as "*What was your*

intention that they [the pupils] would get from this lesson?” (SWE M:2) and “Did you feel that the children were following you? Did they understand?” (SWE M:3).

Learning and progression in mathematics

The issue given most relevance in the Finnish discourse is how to develop pupils' knowledge and progress in mathematics. The following conversation, from G1 in Finland, is an illustrative example:

M1: Why have we done the divisions of numbers so eagerly?

PT11: Well, if one masters them, they help children even in basic addition, especially when they go to the ten transitions, so they know when they have, say $4+7$, how much you need to add to seven to get ten and how much is left.

M1: Yes [...] and now the next work is to teach them how to use them. They're two distinct matters, using them comes when we pass ten.

The connection between formative assessment and ideas for progress is exemplified by a university lecturer, who says *“for example, as a formative test let them write all the divisions of number 9. If one finds this kind of problem-solving strategy, it's easier to remember and check what's missing”* (FIN U2) and then continues *“I wonder if the strategy could be opened, like if we use the nine balls and then move the magnet ruler to make the strategy visible”* (FIN U2).

In the Swedish discourse, issues of learning are typically discussed on a general level, often emphasizing reasoning and interaction: *“[I]t's the journey, they actually learn from the reasoning”* (SWE M4), *“it's very good learning [...] when they teach, and learn from, each other”* (SWE M4), *“you could see the difference all the time, that they're advancing conceptually and how much they understand and can begin to reason a little more”* (SWE M4). This last statement is, in principle, the only statement in the Swedish discourse related to the progression of pupils' mathematical learning. There are no statements about pupils' development of mathematical proficiencies other than that of reasoning. When the mentors and PTs discuss forthcoming lessons, there are few statements about how the pupils' knowledge could be deepened. More common are statements such as *“it's important to go back and do more work on liter and deciliter [...] they need to repeat, over and over again, in order to cement it”* (SWE M2).

Differentiation and individualization

In the Finnish discourse individualization and differentiation of the teaching was present in all four discussions, with respect to both how to organize the classroom teaching in order to meet the needs of different pupils (*“You've now learnt to handle a class with two grades and think about two groups all the time and you've managed it well. Therefore you've already learnt to differentiate the teaching according to two groups. I haven't demanded that you think so much about the individualization within the groups, only a few aspects of handling pupils working at different speeds”* (FIN

M1)), and how to develop mathematical tasks during the lessons in order to present challenges to all pupils (*“One group of pupils understands immediately, okay this kind of task, and writes it mathematically at once, whereas others need more time, and they should have the right to go on with their thinking process for a longer time”* (FIN PT11)). We conclude that aspects of how to plan and adjust the classroom teaching to ensure that each pupil receives appropriate mathematical challenges is very typical of the Finnish discourse. In the Swedish discourse, the issue of how to arrange the classroom teaching in relation to the pupils’ diverse pre-knowledge and interests is not made relevant. However, the importance of helping/teaching the pupils in one-to-one situations is stressed. Supporting pupils who have difficulties was mentioned once, when a mentor referred to special education teachers and their responsibility for this.

Mathematics and its connections to everyday experiences

One of the most specific features of the Swedish discourse is the emphasis on the importance of connecting mathematics to everyday experiences. Such everyday experiences are typically not formalized into mathematics, but are seen as mathematical activities in themselves. For instance, one of the mentors states that *“mathematics [...] is loads of everyday experiences”* (SWE M2). Therefore, everyday experiences are typically put forward as relevant in themselves, not for deepening mathematical concepts or ways of reasoning. The situation in the Finnish discourse is different; only once is a connection to everyday life mentioned, in the context of feedback from the mentor to the student: *“And I think that was a really good example you gave [before the lesson] but it didn’t appear during the lesson, talking about something like there are no people within a radius of a hundred kilometers or five kilometers, but you forgot it, that would’ve been a good example about where we can use the concept of radius”* (FIN M4).

Assessment

Assessment is another dominant theme in the Finnish discourse. It mostly concerns formative assessment connected to learning and progression in mathematics, as shown above, but also concerns the principles of giving pupils their grades in mathematics, and the difficulties in working with assessment are acknowledged in the discourse. When discussing pupils with wrong answers in their homework, one mentor states that *“one has to react with some questions and try to sort out whether the pupil is way off track, and this is difficult for the teacher”* (FIN M4). Another typical example regarding formative assessment is the following: *“Yes, the goal of the lesson was to draw a circle according to the given rules and internalizing the concept of a circle. I’m sure they learned to use the compasses by doing it, but I wonder how it is with their ability to draw according to the rules since you gave them a lot of freedom. So we could now think about giving quite strict rules and checking whether they can draw a circle with, for example, a diameter of 6cm or a radius of 3cm, and then it’s easy to see who has succeeded and why somebody hasn’t succeeded in doing it”* (FIN M4).

The mentors also pose questions about student learning so the prospective teachers have to be aware of how the pupils progress: *“Yes, but otherwise everyone’s done the tens table right (in a test) and Silja and Aapo are the only ones who aren’t ready with the twos table...”* (FIN PT1).

Assessment is only briefly touched upon in the Swedish meetings, when mentors ask the PTs whether they think the pupils understood the content of the lesson, but they do not give explicit suggestions for how one might get this information. The mentors and PTs discuss the importance of meeting the pupils’ one to one, or having the time to watch them work in smaller groups, in order to get a grip on what parts of the content they understand as well as how they understand them.

Classroom management

The aspect given the most relevance in the Swedish discourse is organizational issues regarding pupils and artefacts. How the pupils should be grouped (*“When I was thinking about it in retrospect, maybe one should’ve separated Anna and Jennie so that Eric, Maria and John could’ve been with one of them”* (SWE PT4)), where the books should be stored, the importance of being clear when writing on the board or pointing to exercises, which measuring spoons to use and the length of the teacher’s introduction (*“and when they have to sit for so long and listen [...] then it’ll be tiresome to sit and concentrate”* (SWE M3)) are examples of such issues. This finding of the heavy focus on organizational issues harmonizes with the recent study by Hegender (2010) about mentor-PT discussions during SBTE in Sweden.

Classroom management, like the use of manipulatives and ICT, is also clearly present in the Finnish discussions connected to, for example, formative assessment and disciplinary issues: *“It was good that you solved the problem of who the head of the group is so quickly, so that everybody could start working in time”* (FIN M4). One university lecturer states that if the group is intense and impulsive one could let pupils explain as a way of handling the group: *“When a classmate is saying something the others are trying to listen”* (FIN U3). Another example of managing the class is the following comment about how to start a lesson: *“You wait until you have all the children’s attention, all the children are looking at you, they’re ready, there’s no use saying something before that”* (FIN M4).

The mentors typically also suggest ways to organize the teaching in a way that makes pupils’ learning visible and allows them all to be active in engaging with tasks: *“Yes, and again the pupils can have the number cards on their desks as the number area isn’t so big when solving equations in their head, so that all the pupils at once can show what number we can put in the square so that you don’t need to say ‘raise your hands’, but here also the teacher gets immediate feedback about who’s way off”* (FIN U3).

Mathematics textbooks

Mathematics textbooks are referred to three times in the Finnish discussions, and all these references explicitly deal with the treatment of the specific topics: investigation of divisions (*“Tuhattaituri [the name of the textbook] uses exactly this model where one moves the vertical line when investigating divisions”* (FIN U2)); the notion of a product and the value of a product (*“But the textbooks are like this, it’s not only in our textbook but also the others that I’ve studied, but if we think back to year x, the beginning of my teaching carrier, there they were already separated [product and the value of the product]”* (FIN M1)); and the use of the number line (*“[...] as even some researchers say, this book series uses the number line too much, is it true and whom does it suit, I don’t know”* (FIN U2)).

In the Swedish discourse the textbook is more prominent. They do not discuss specific topics in more than one episode; instead, the pupils’ use of the mathematics textbook is either mentioned as the main part of the lesson or seen as a goal of the lesson that the pupils can work individually in the textbook. After one lesson when the pupils have worked in the mathematics textbook for practically the whole lesson, one mentor says *“Well it was a very ordinary lesson as many of them are”* (SWE M1). *“[T]he book is something they should be able to work in on their own”* (SWE M3) is a statement from another mentor, who later in the discussion says that *“if one were certain they understood and then started with the book [...] one could do a demonstration and then they could work on their own”* (SWE M3).

Resource constraints

Issues about constraints regarding both time to plan lessons and the length of lessons are brought up several times in all four Swedish meetings. One mentor refers to changes in teachers’ working conditions: *“This dilemma that we’re struggling with right now, [...], when I started working as a teacher, I had plenty of time to, sort of, plan lessons, to really think through what I wanted to do, I made my own material and such. But now that time doesn’t exist”* (SWE M1). Especially the PTs express that they do not have time to do all they want: *“I’d planned to do that at the end, but we didn’t have the time”* (SWE PT2). The same PT mentions that the lesson in consideration would have been impossible to realize if he had been the only teacher in the classroom: *“I wouldn’t have been able to carry this out on my own”* (SWE PT2). The mentor continues: *“No, and that’s why we have a special education teacher”* (SWE M2). Hence, an implicit assumption is that productive teaching is more or less impossible to conduct without several teachers present in the classroom.

Resource constraints are made relevant much more seldom, and in a different way, in the Finnish discourse. The mentors and PTs do not focus on time constraints as a problem but instead on how to cope with them. Aspects of the importance of the teacher staying calm are emphasized, as is the importance of not transmitting the feeling of stress to the pupils: *“If the teacher herself has a hurried feeling this is easily transmitted to the children”* (FIN M4). They also discuss issues concerning the

teachers' responsibility to adjust the plans for the next lesson by considering issues that could not be handled during the current lesson: *"As a teacher one should hold the threads in one's hands and think that I'm going to sort this out then and how we can repair this next time, it shouldn't be the pupils' responsibility if the use of the time during the lesson hasn't worked as the teacher had planned"* (FIN PT21).

CONCLUSION AND DISCUSSION

The results indicate that there are rather substantial differences between the discourses of the Finnish and Swedish groups. We cannot generalize the results from the present study to the two countries, but they add to the growing body of knowledge obtained from the previous studies. We could further compare the discourses by introducing preliminary results of how the teacher's and students' respective roles are conceptualized as well as discussing aspects of specificity and structure of the discourse. As described above, the teacher's practice within the Swedish discourse is conceptualized in terms of a "supervisor" who should primarily engage in one-on-one discussions with pupils. This finding is in line with findings in Hemmi & Ryve (2012), in which Swedish mathematics teacher educators typically portray classroom teaching as a teacher-talking-with-one-student phenomenon. In contrast, the Finnish discourse puts much more emphasis on whole-class teaching and the teacher acting in whole-class situations.

In the Swedish discourse the pupils are described several times as resources, in teaching and gaining understanding from each other: *"It's very good learning [...] when they teach, and learn from, each other"* (SWE M4). One thing that is mentioned as an obstacle to pupils' understanding is their level of maturity, which seems to take precedence over the teaching. An example of this is: *"Well, you also have to realize that they're not that big yet, they don't have it, it's not close to them"* (SWE M4). In the Finnish discourse the teachers' responsibility of students' learning and students' behaviour is stressed in different ways.

Another typical recurrent pattern in the discourses is that Finnish mentors and PTs are rather specific in talking about mathematics, pupils' learning, goals of the lessons, etc. Our analysis of the Swedish discourse suggests that the statements, suggestions and reflections upon the classroom practice are formulated rather generally. This aspect is also related to a fourth characteristic we noticed: the Swedish classroom teaching as well as review meetings are loosely structured, with few explicit frameworks or plans for how to act. For instance, as indicated above, lesson plans are typically not produced or made relevant within the discourse as a way to structure the review meetings. In contrast, the Finnish context is structured through, for instance, lesson plans, visits from university lecturers, and explicit discussions of the lesson goals. Possible explanations for these differences could be the different position of the mentors in the system. Our initial analysis has not revealed differences between the characteristics of the feed-back discussions conducted by the mentors (class teachers) on the one hand and the university lecturers on the other hand in the Finnish context. A deeper analysis of the whole data could inform us whether the presence of

the university lecturer seems to have a positive effect on the qualities of the review discussions and in that case how.

This paper should be seen as a contribution to the research on SBTE and especially on ways of characterizing the discourse of university lecturers, mentors and PTs (cf. Jaworski & Gellert, 2003; Sowder, 2007). The analysis of four meetings from Sweden and Finland shows some similarities, but also many differences. Basically, teaching mathematics seems to be conceptualized in two distinct ways, and in future studies we aim to both complement the study by analysing more data and deepen the analysis by contextualizing the results within a broader frame of similarities and differences between the two countries regarding aspects such as classroom teaching, teacher education, the role of school in society, and cultural patterns. We believe that such an approach could add to the research discourse on the role of SBTE in educating PTs in mathematics, assistance teacher educators in making informed choices about SBTE, as well as deepen the understanding of pupils' learning of mathematics in Sweden and Finland.

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