

**TOWARDS AN UNDERSTANDING OF HOW THE SWEDISH
PRESCHOOL CONSTRUCTS MATHEMATICS**

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**TOWARDS AN UNDERSTANDING
OF HOW THE SWEDISH PRESCHOOL
CONSTRUCTS MATHEMATICS**

Children being and becoming mathematicians

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Preschool – a place for both planned action and the unexpected and unpredictable nature of children’s questions and curiosity in the current activity.

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STUDIES INCLUDED IN THE THESIS

Study I (Article I)

Lembrér, D. (2013). Young children's use of measurement concepts. In B. Ubuz, Ç. Haser, M. A. Mariotti (Eds.) Proceedings of the Eighth Congress of European Society for Research in Mathematics Education (pp. 2148-2157). Ankara: Middle East Technical University.

Study II (Article II)

Lembrér, D., & Meaney, T. (2014). Socialisation tensions in the Swedish preschool curriculum: The case of mathematics. *Educare Vetenskapliga Skrifter*, 2014: 2 (p. 89-106).

Study III (Article III)

Lembrér, D., & Meaney, T. (Submitted). Towards an understanding of preschool activities: Bringing being and becoming into the mathematical activity.

PART ONE: SETTING THE STUDY

1. INTRODUCTION

This thesis is a collection of three articles and an extended summary or overview binding the work together (kappa). The thesis is divided in two parts: part one provides background information to the study, and part two comprises the articles and a concluding discussion. In the following chapters, I introduce the development of the whole study and situate the conference paper, two journal articles and the research questions within it.

Chapter 1 includes my personal story and the assumptions about children's own experiences; the research questions of this study are provided at the end of this chapter. In Chapter 2, I describe the Swedish preschool, earlier mathematics education research in preschools and provide an overview of related literature. Chapter 3 presents the theoretical framework for my study, where the sociological terms of "being" and "becoming" are given a context within studies of childhood. Chapter 4 comprises the introduction to the methodology used in the study, together with a description of the participants and the data analysis.

In Part two, Chapter 5, I introduce an overview of the conference paper and two articles, then provide the articles in their original form. Chapter 6 presents the discussion and conclusions for the entire study.

My personal journey from preschool teacher to education researcher

Before I started as a graduate student in February 2012,¹ I had been working in preschool for a couple of years, a role that made me aware of the complexity of the preschool teacher profession. It

¹ For more information about the graduate school, see <http://www.mah.se/Forskning/Utbildning-pa-forskarniva/Amnen/Forskaraskolor-for-forskolan/FoBaSM/>

appeared to me that there were factors that influenced my pedagogical practices and it was these that I wanted to explore.

When I applied for graduate study, my interest was to investigate mathematics education in the Swedish preschool (Skolverket, 2011) and particularly to focus on subject learning in the preschool, particularly mathematics. It seemed meaningful to investigate the influence of school and perhaps the compulsory school curriculum on what preschools were expected to offer in the way of learning activities. This turned me in the direction of investigating mathematics activities in preschool.

This research has enabled me to explore mathematics education in the Swedish preschool, not to determine the reasons for various actions and/or mathematics activities in preschool (previously studied by Doverborg & Pramling Samuelsson, 2011), but to investigate the complexity of mathematics in preschool. In particular, by using the sociological terms “being” and “becoming”, I could explore the value of children’s own engagement as a reflection of their experiences, knowledge and skills, within the institutional practices of the preschool.

In this introductory section, I first describe the Swedish preschool, an institution that reflects the conditions of childhood in today’s society. This specific context reflects specific sets of attitudes toward childhood. The pedagogical practices, including the use of children’s own experience, sets up the norms and values, that children should gain through socialisation. In this way, care, socialisation and learning are supposed to come together to form a comprehensive whole (Skolverket, 2011).

Assumptions about children’s experiences

When children attend preschool, they bring with them experiences from outside which can be the basis for developing their mathematical thinking. Through implementing activities based on the curriculum, the preschool institutionalises the needs for a democratic citizen, subject learning and children’s own interests as some of the norms and values that society expects to be reproduced. James and Prout (2001) stated that children’s participation in activities designed or adapted by their teachers will contribute to them being socialised; I discuss this in more detail in Articles II and III and in the next chapter of this overview. In this way, the preschool teacher has an opportunity to operationalise the norms and values. As children learn while engaged in these activities, societal norms and values are reproduced. Thus, learning

is associated with socialisation but with children are seen as important agents in preschool activities.

It has long been known that teachers and children interactively can construct meaningful activities which have shared values and inspire children to explore their surrounding world (Coates & Coates, 2006). In the preschool, there are possibilities for knowledge creation, with children having the opportunity to develop their own experiences and make choices in the light of those experiences (Karlsson, 2011). Thus, the interaction and conversation between a teacher and children are important. As Fler (1995) highlighted, teachers need to focus the children's attention on specific phenomena. Supporting children to explore their own motivations for engaging in mathematical activities, beyond what the teacher has planned, can lead to new thoughts (Fler, 2010). Consequently, the teacher's role cannot be reduced to observation; rather, the teacher needs to conceptually engage with children so they investigate the phenomena further. Children acquire the understanding, skills and awareness of different mathematical concepts, developed in the course of their own experiences (see for example, Brenner, 1998), through the process of learning and the reproduction of norms and values (Lee, 2001).

The challenge for early childhood educators is to recognise and interpret children's perspectives (Pramling Samuelsson & Johansson, 2009). Two aspects have been researched in this area. The first revolves around the importance and interest in children's own experiences (Coates & Coates, 2006); the second tries to understand how teachers identify and use children's own experiences in mathematics. A third point of view, which has had less focus as a research area, is to consider how activities and support children in developing an understanding of mathematical ideas. I investigate this perspective by considering children's socialisation. As discussed in detail in Articles II and III, the process of socialisation, described in Chapter 2, includes considering children as being knowledgeable, active participants in the construction of their childhood and their own experiences (James, Jenks, & Prout, 1998).

Aim and scope

In the beginning of this study, my focus was on investigating activities involving mathematics where teachers built on children's own experiences. However, the focus switched to trying to better understand and explain the broader picture of how children are

socialised through mathematics. This new focus allows for a better understanding of how links between institutional and global discourses of childhood in today's society can be used to specific preschool systems or preschool activities.

Consequently, the overall aim of this study is to explore mathematics education in the Swedish preschool through considering children's socialisation. My intention has been to make a contribution to the field of early childhood education and to develop an understanding of the complexity of subject learning, which has often seemed to be taken for granted. The conceptualisation of early childhood education, being a product of historical development is itself open for change as society's perceptions of childhood change.

Socialisation as a process of creating/recreating society and the transmission of culture is connected to perceptions of what young children are capable of doing. Walzer and Miller (2007) stressed that within culturally diverse societies, educational opportunities provide an understanding of some of the meanings to be found in that society. An example of this can be seen in Chapter 3, where I discuss children as active participants in social life, rather than as passively becoming adults as a result of socialisation.

Trondman (2013) considered it to be unreasonable to talk about childhood without looking at the environment that includes children's multiple worlds. Therefore in my study, in the milieu of the preschool is investigated and children's experiences treated as an aspect of socialisation, preschool. In this way, the preschool curriculum provides the boundaries of the institutionalisation. Children's becoming is supported by the curriculum goals for developing their mathematics skills, and children's being mathematicians is supported by recommendations that their experiences and knowledge should be used. (This is explored further in Article II and the section "Mathematics activities in preschool" in Chapter 2 of this overview).

The research questions

Two research questions motivate this thesis:

- What is the influences of mathematics education on the socialisation in Swedish preschools?
- How are the concepts of being and becoming mathematicians operationalised in a Swedish preschool?

2. MATHEMATICS AND THE SWEDISH PRESCHOOL

In 2010, The Swedish National Agency for Education (Skolverket) revised the preschool curriculum which had been written in 1998 (Skolverket, 1998). One of the main reasons for the revision was to enhance professional education and to strengthen pedagogical practice (Utbildningsdepartementet, 2010). The revised curriculum is a goal-oriented curriculum, without suggestions about how to teach. It is expected that teachers' professionalism should guide them to make decisions about what to provide to children. Thus, in the curriculum the preschool teachers' pedagogical responsibility is clarified, but how mathematics would be carried out in activities is not.

In this chapter, I discuss the curriculum and the Swedish preschool. The chapter ends with an overview of previous research on mathematics education for the early years.

In terms of curriculum

The curriculum for preschool or school can be interpreted differently by groups of people such as politicians, teachers', parents and children. For example, Kelly (2009) defined it as "the totality of the experiences the pupil has as a result of the provision made" (p. 13). The OECD (Organisation for Economic Cooperation and Development) states that the purpose of a curriculum in schools and preschools is to include learning to become (for confidence); learning to do (experiment, play and interact); learning to learn (specific learning objectives) and learning to live together (respect for differences and democratic values) (OECD, 2006). However, in this thesis, curriculum refers to what Skolverket (2010) calls Läroplan, a written document that

outlines goals and guides preschool teachers and working teams when planning preschool activities. When I discuss the provision of activities for children, I describe this as the operationalisation of the curriculum. Linde (1993) describes how the process of transforming the curriculum can be viewed differently as different actors operationalise it, depending to some extent on the expectations that the actors have on one another.

Changes in the education system, including the curriculum, require an expansion of professional teaching responsibilities, including producing local goals, documentation, evaluation and development of the preschool. Teachers also need to have knowledge and reflectively relate to the teaching strategies used in activities provided for children. To do this, teachers often make use of the information in the curriculum as well as other sources to support their knowledge and reflectivity. Curriculum studies on the history of preschool for the youngest children provide knowledge contributing to a critical reflection on and operationalising of curriculum including documentation and assessment (Vallberg Roth, 2001; Vallberg Roth, 2013).

Vallberg Roth (2011) presented a historical review of the younger children's curriculum from mid-19th century to the first decade of the 2000s. Historically, care, nurture and social development have been the main objectives of early childhood education and care (ECEC), especially in Sweden and other Nordic countries.

In this section, two key notions are discussed: recent changes in the Swedish preschool curriculum where mathematics goals are extended as a response to global discussion about the role of mathematics in preschools (see Duncan et al., 2007), and operationalisation of mathematical activities within institutional settings.

The Swedish preschool as part of a wider educational system
In the early 1970s, preschools expanded rapidly with a growing number of children attending. This put pressure on preschool groups to change their organisation and pedagogical content. In the early 1990s as part of a decentralisation drive, Sweden moved control of the schools from the central state to the municipal governments. During the same period, preschool as a social institution changed to being seen as an institution of learning. Preschools, which had previously belonged to the government department of welfare gained a new master, the Swedish National Agency for Education (Skolverket). The responsibility for

organisation of preschools was given to the municipalities. This decentralisation was important for the implementation of preschool policies. At the state level, curriculum and national guidelines are regulated. At the public level, it was the preschool principal's task, based on the stated goals, to organize the preschool. At the local level, preschool teachers operationalised the preschool curriculum goals by planning and implementing activities that work towards achieving them (Åsén & Vallberg Roth, 2012).

These perspectives highlight the importance of studying the goals and guidelines described in the curriculum and can be seen as a key to what a society regards as important for children to learn in the given period of preschool education. By analysing the Swedish preschool curriculum in Article II, I was able to use the sociological concepts of being and becoming to identify potential tensions that preschool teachers might face in their operationalisation of it.

Children's becoming is organised by institutions' norms and values (political, educational and administrative processes), and these have profound effects on children (James & Prout, 2001). Research studies of early childhood provide a frame for understanding in terms of social construction. In the context of Sweden, it needs to be underlined that in the year 2013 some 77% of children aged between one and three years attended preschools, and this increased to 94% for children aged four to five years.² Thus in Sweden, children can be said to be socialised in institutions.

The Swedish preschool curriculum

The Swedish preschool curriculum, both the original one from 1998 and its revision from 2010, contains goals for preschools to strive towards. The goals are not described as things to be achieved, or to be used to compare children to anyone other than themselves. The first preschool curriculum (Skolverket, 1998) was revised in 2010 in order to develop the quality of the education and strengthen the pedagogical work done in preschools (Utbildningsdepartementet, 2010). An important reason for the revision was to clarify the preschool teachers' responsibilities for developing preschool activities. Hence, the revised curriculum (Skolverket, 2011) uses the word "teaching" to emphasize the teaching task of preschool teachers.

² For more information see <http://www.scb.se/en/>

The revised preschool curriculum does not include suggestions for pedagogical approaches. Instead, it requires activities to be based on children's experiences, interests, needs and views. In a report for the Swedish National Agency of Education (Skolverket), Johansson (2011) stressed that the Swedish preschool curriculum clearly states that children's own experiences should be actively drawn upon in preschool contexts because it is a source for knowledge and learning. Activities are to be based on a creative form of play, with opportunities for other kinds of expressions.

Preschool as an institution

Preschool as an institution is a place where children's social context and experiences are formed (Ebrahim, 2011; Markström & Hallden, 2009). Preschool is a part of children's lives, with a specific focus on learning and development.

The preschool curriculum stresses that care, socialisation and learning together should form a comprehensive whole which includes and should facilitate mathematical learning through play (Skolverket, 2011). Play is considered as having a leading role in developing children's knowledge from an early age (Vygotsky, 1933/1966). Play and enjoyment in learning, is considered to stimulate the imagination, insight, communication and the ability to think symbolically, as well as develop cooperation and problem solving skills. Playful activities should be carried out so they stimulate and challenge the child's learning and development (Vygotsky, 1933/1966).

As well, within the Swedish preschool curriculum, there are subject goals (in mathematics, literacy, numeracy and other subjects). These are situated as possibilities for knowledge "that children in the future can acquire" (Skolverket, 2011, p. 5). However, it may be that focusing too much on the future can limit the child's own hunger for knowledge and their willingness to engage in mathematical activities (Sarama & Clements, 2004).

Emphasising the need for preschools to prepare children for school learning must be considered as part of the broader views about education across different institutions. For example Clements and Sarama (2004) have expressed concerns about preschools inhibiting children from learning the deep mathematics that they are capable of. Thus, the importance of mathematical knowledge as raised by researchers such as Duncan (2007) can be considered as contributing to the framing of the processes of learning (this is discussed more in Article II). If the process of socialisation is for children to gain valued knowledge about the

subject, as part of the reproduction of society's key institutions, such as the family, culture and norms (Lee, 2001), then children may need to recognise the activity as mathematical. This process of socialisation provides an educational structure which children learn to recognise and interpret (Trondman, 2013).

Mathematics activities in preschool

The focus on learning through play has been critiqued. Children have been documented as learning some mathematics through free play (Coltman, Petyaeva, & Anghileri, 2002), but researchers others such as J. S. Lee and Ginsburg (2009) have suggested that free play does not afford the explicit examination of mathematical ideas that adult guidance can provide.

Van Oers (1996) stressed that when children are involved in a reflective way, they can learn in interactions with each other and the teacher. In interactions, the teacher can structure assistance to the children through, for example, asking questions, giving information or summarising children's own understanding. By interacting with the children, the teacher has opportunities to challenge their ideas and to have them describe experiences or thoughts (Clark & Statham, 2005).

Research, such as that reviewed in Clements and Sarama's (2007) international handbook chapter, indicates that the development of young children's mathematical ideas and skills has come to be regarded as one of the core purposes of preschools. For example, discussion of number as the cornerstone on which subsequent mathematical abilities are built is mentioned in much of the research about mathematics education for young children. In relationship to this, Butterworth (2005) raised two important points in regard to what young children are doing, enjoying and understanding. The first is that children's lack of understanding about number can lead to confusion, avoidance and to a lack of further learning; the second is that increased confidence can lead to a desire to engage in further practice. In contrast, activities based on other mathematical concepts such as amount, shape and size, showed that exploring mathematics and taking children's intentions as a starting point was valuable for children's learning (Björklund, (2012). Nevertheless, Björklund's research focused on how teachers used the terms that she had identified as mathematically valuable in the activities that they had planned. This can be considered a case of how the institutionalisation of the activity gave value to mathematics over other aspects of the

activities. This valorising of mathematics may constrain teachers from being able to see aspects of mathematics outside the frame of preschool curriculum. This aspect is expanded in more detail in Articles I and III.

Children's own experiences as core for learning

From the perspective of pedagogical practices, Karlsson (2011) suggests that there is a need for discussion about how children's own experiences can be used as a starting point for activities. The primary focus of Karlsson's (2011) research was on how the teaching and learning process was revealed in dialogues between teacher and child. The teacher's intention was to give inspiration for stimulating the child's creativity, in the form of a musical experience. The approach aimed at creating a cultural experience in form of music which had the potential to be a personal experience, tied to the children's previous experiences. In this way, children's experiences became institutionalised through the teacher's intention to connect music and art, as part of the curriculum goals about children developing their creative abilities, including the ability to convey impressions in the form of pictures, song and music.

Recognition of the importance of children's own experiences and thinking obligates the teacher to encourage children to use their everyday experiences as tools to develop mathematical skills (Carruthers, 2006). Doverborg and Pramling Samuelsson (2011) highlighted the need for children to learn from their own experiences in a way that makes sense to them both presently and in the future, both when at school and as adults. Children's own knowledge can initiate a starting point for imitating social interaction in play and promoting construction of subject knowledge (Edo, Planas, & Badillo, 2009). Consequently, the preschool teacher has to find meaningful situations and ways to communicate which challenge the children to ask questions, reflect and discuss situations (Clarke, Clarke, & Cheeseman, 2006). Doverborg and Pramling Samuelsson considered that in participating in various activities such as dividing fruit or setting the table for a meal, children communicate and try to understand the phenomena. Through these interactions, children have opportunities to explore their own and other's ways of understanding mathematics (Björklund, 2010). However, if the teacher does not have appropriate knowledge, he or she cannot encourage and challenge young children's mathematical awareness (Pramling & Pramling Samuelsson, 2011).

Carruthers (2006) drew attention to one of the main goals of early years teaching, that is, to help children make links between the mathematics they have already encountered (and continue to engage with) at home and the more abstract mathematics of the school. In Carruthers's (2006) research, the use of children's own mathematical representations, within a context of visual illustrations, were considered to represent their thoughts and ideas. The children were unaware of the formal mathematical language for representing their ideas that the teacher introduced.

It is evident that discussions about mathematics in preschool are related to several components, such as school readiness, knowledge and skills, and societal values. The relationship between different discussions is worthy of investigation; the processes of socialisation and being and/or becoming mathematicians are therefore further described in next chapter and in Articles II and III.

3. SOCIALISATION AND CHILDREN'S BEING AND BECOMING

As the project progressed, socialisation became a focus in relation to how mathematics education in preschool was operationalised. In this chapter, therefore, I elaborate on the discussion about socialisation which is addressed in Articles II and III. The discussion is based on theoretical developments in childhood studies and a conceptualisation and approach that I investigate in my study that focuses on children's being and becoming in society. Children should be perceived as persons with their own rights, interests and experiences and acquiring the skills necessary to perform as functioning members of their society.

Socialisation for young children has been equated with a process and as a journey towards adulthood. This journey contributes to children gaining knowledge of their and others' roles in society, in order to reproduce society's key institutions, family and norms (Lee, 2001). From this socialisation theory, the child is seen as developing socially, engaged with the process of change and alteration, with a main end goal of being an adult. Traditionally, childhood researchers work on understanding childhood expressions as evidence of the development of adult skills as steps towards adulthood.

With help from Giddens' definition from 1984, Ebrahim (2011) defined socialisation as the process by which people, who inhabit a society, create it. Alternatively, James, Jenks and Proud (1998) stressed that socialisation includes a transmission of culture from one generation to another, to ensure that societies sustain themselves over time.

The differences in perceptions of socialisation, as a process of creating/recreating society and a transmission of culture can be connected to perceptions of what young children are capable of

doing. For example, Lee (2001) discussed how a young child's age affected adults' perceptions of them having rights to have opinions and desires, as often children's age has been taken to mean that they are not worth listening to. Discussions such as these make it difficult to recognise children as fully human or people in their own rights (James & Prout, 2001). Children are recognised as being individuals with responsibilities and opportunities that they can influence, which then contributes to them becoming socialised.

James et al., (1998) exemplify children as agents who actively and competently create and participate in their own construction of childhood. Consequently, researching early childhood education by listening to and observing children has become common (Dockett, Einarsdottir, & Perry, 2009).

Social interactions within a society should be seen as contributing to the production and reproduction of rules and structures (Ebrahim, 2011). From this perspective, children's interactions can lead to reproduction of existing roles as well as the production of new roles, which do not compared children to adults.

Ebrahim (2011) emphasises how and where young children through strategies gain control and engage in social life in early childhood settings. These strategies are: resistance, avoidance and ignoring and collaboration. Strategies of resistance, in Ebrahim's study, showed that children are not passive receivers of instructions from preschool teachers. Children used the skills and knowledge they possessed to gain control; in fact, they were active constructors of childhood. Avoidance and ignoring strategies were used to escape the control of other people (for example, a child avoiding answering a question posed by an adult). The strategy of collaboration is the concept of "we" within shared intention (for example, children using imaginary characters during play). Examples such as these can be seen in Article I, The point was emphasised in my conference paper, where children used their own experiences of travelling, using toy vehicles to develop the interaction around drawing the map. This is consistent with the acknowledgement that children should be seen as agents and as inclusive participants who produce and reproduce knowledge and understanding about their lives. Ebrahim (2011), in summary, observed the need to raise children's own concerns and priorities in research. Ebrahim's (2011) strategies are not been use in the analysis on the different articles because my aim was on broad processes which affected children's socialisation.

If the further direction of my research work is to consider investigation of children's individual level when they engage in mathematics activities in preschool, then these strategies will be of use.

The concepts of being and becoming in this study

In this section, I describe the concepts of being and becoming as they are used in Articles II and III. The discussion of these concepts here is complementary rather than distinct from the material in the articles, where limitations of space in the journals do not allow for this more detailed explanation of the two concepts that are paired in one part of the analysis in Article III.

As referred to in Articles II and III, children can be considered as active social beings, construct and create social relationships, rather than being solely dependent on adults (James & Prout, 2001). The division between being and becoming is a product of historical development and as such it is open to change (Lee, 2001).

Being and becoming separate the complete and independent from the incomplete and dependent child. The being child, however, is not static, for neither is time. Consequently, children should be considered as having important roles in society, where adults expect them to one day "take over", so they need to know and understand what is needed to secure their future (Lee, 2001). From the being perspective, children are knowledgeable, intentional and skilled actors, capable of using these skills in securing their futures.

When being and becoming are complementary

Uprichard (2008) stressed that concepts of being and becoming can be complementary and are not necessarily to be considered as in conflict in the construction of childhood. The "being" child as a social actor who constructs childhood as a journey between childhood and adulthood, must not be distinguished by aspects of time. The main reason for this, according to Uprichard, is to not differentiate the child and the adult. She considered the dominant framework, which refers to developmental understanding of childhood as progression towards adulthood (Qvortrup, 1994), to be a barrier in research. Uprichard referred to Prigogine's work on time and change in a dynamic system. If a timeline is crucial for concepts of being and becoming, then in a view of the diversity of childhood and of children's agency would be limited.

When being is considered as the present, with becoming the future, there is a lack of recognition that both timeslots interact together in the course of children's everyday life. The time of childhood is about the being child, while the becoming child is the one who is growing older. This possible account of childhood, seeing children as more legitimate and as being rational is illustrated in the examples in Article III, in the activity where children drawing a roadway and building a bridge. These examples show how children become aware of something in order to solve a problem and that was not is not a passive process. These children were active agents in determining what they did not know and in learning new skills and knowledge for solving their immediate and joint problems. Prout (2005) argued that differences between being and becoming are no longer justifiable. One reason is that both children and adults need to be seen through a multiplicity of becomings, where all are incomplete and dependent. If both children and adults can be considered as having a multiplicity of beings and becomings, then positioning children and teachers as knowledgeable can be considered as beneficial for understanding the learning that occurs in preschools.

A reflection of these concepts of being and becoming, in relation to my project, is the positioning of children's own experiences as being valuable. The social world is the product of the ways in which children and adults give meaning to the world through their actions and interactions. In the preschool, in order to broaden the possibility for a cultural experience, children's becoming allows for the reproduction of culture from one generation to another, (James, Jenks, & Prout, 1998). This is additional to the argument of how children's socialisation processes, which I investigate in Article II, are shown to be profoundly influenced by institutions' norms and values (political, educational and administrative processes) (James & Prout, 2001).

In terms of being and becoming mathematicians

In this section, I briefly discuss how the concepts of being and becoming can be used reflectively to evaluate the role of mathematics education, in children's socialisation, which is discussed in Article III. This is done through exploration of the operationalisation of the curriculum. The goals and guidelines of the curriculum are analysed in regards to being and becoming in Article II.

In regard to the revised curriculum, I needed to consider what being and becoming a preschool mathematician might be. Further investigation of actual mathematical activities was therefore made in Article III, where the focus and discussion is on being and becoming mathematicians and definitions of the concepts are developed.

Socialisation, learning and education

In this section, I link socialisation with learning and education. To do this, I use Biesta's definition of socialisation and education which are also discussed in both Article II and Article III.

Biesta (2007) made a distinction between socialisation and education to highlight how learning occurs. Similarly, Radford (2008) described learning as "not just about knowing something but also about becoming someone" (p. 215). Biesta (2007) considered socialisation as the "insertion of 'newcomers' into existing cultural and socio-political settings" (p. 26). For him, much of what occurs in institutional settings is socialisation. Biesta described education as defined by Kant as being the self-education needed to achieve rational autonomy in order to become fully human. He argued that this view of education should also be considered a form of socialisation because it sets up what the end product of self-education had to be, that of rational autonomy. Education of this kind resulted in individuals taking on the attributes of existing members of a society but without a recognition of the role of the community in this process (Radford, 2008). For Biesta (2007), this philosophy suggests that those who did not have or did not gain the appropriate attributes could not be considered human. Young children fitted into this category of non-human as they were not considered to have obtained the necessary rationality. In contrast, he postulated that education should be deemed as preparation for an uncertain future, which freedom "needs to be realised again and again" (Biesta, 2007, p. 32).

When children's socialisation is discussed in terms of becoming mathematicians, learning and developing mathematical skills are considered to be crucial. Radford (2008) said, "Learning does not consist in constructing or reconstructing a piece of knowledge. It is a matter of actively and imaginatively endowing the conceptual objects that the student finds in his/her culture with meaning" (p. 223).

Children are often actively engaged in mathematical activities, not to construct new knowledge but to make sense of existing

knowledge in a process of cultural reproduction. Becoming aware of this knowledge can be seen as an active process of meaning making based on an understanding and interpretations where the being child is capable of encountering new experiences, perhaps new knowledge. In order to learn, for example, the concepts of measurement as the children did in Article I, objectification and subjectification occur (Radford, 2003). As the children drew their map, they became aware of the importance of different measurement attributes like the length of the boat and the height of the train. These attributes were objectified and as the children became aware of the objects, they were positioned both as being mathematicians, who could utilise the knowledge that they already had and becoming mathematicians who gained culturally valued knowledge. Consequently learning through objectification and subjectification is a process in which socialisation through being and becoming mathematicians is bound together.

The overall aim of my study is to gain a broader understanding of the influences of mathematics education in the Swedish preschool through considering children's socialisation. The study underlined the importance of socialisation as a processes which is transmitted through cultural practices and connected to perceptions about childhood.

As discussed in Article II, in the revision of the preschool curriculum, as they are followed, the number of goals and guidelines related to school content such as mathematics has increased. Curriculum as a body of knowledge is an example of institutional norms and values. The goals and guidelines for mathematics are operationalised through pedagogical practices. In Article II, it was indicated that schoolification is influencing preschool education in Sweden and this may have an impact on the social formation of children's and adults' conceptions of childhood. Drawing on Biesta's definition of education, rather than specifying any predefined knowledge skills or abilities as being necessary for children's futures, it is essential to better understand the complexity of subject learning and children's agency.

Both Article II and Article III use the concepts of being and becoming to determine how children are positioned as being and becoming, as a socialisation process. This has also allowed me to consider how learning is connected to socialisation and education.

4. ON THE METHODOLOGY

In this chapter, I describe the methodology of this study. I address ethical considerations, reflect on choice of method, and discuss in particular the method used in Article I, which was also used for Article III. I explain the use of field notes rather than video recordings and consider possible limitations. Further discussions of methodological considerations are provided within all three articles.

A description of the context of the preschool which was the locale for the data used in the initial study (Lembrér, 2013) is provided in Article I. However, I would like to add that this study was situated in the outskirts of a small town in southern Sweden. The preschool there was age-integrated, with 17 children in the group. “Age-integrated” means that children were not split into different age groups but all children interacted in a single group. A group of five children aged between two and six years was the object of the analysis during a play session. In this group there were two girls and four boys. The girls were both four years old, and boys were aged two, four and six years. Throughout the preschool day, the children were together with three preschool teachers: two of them had preschool teacher education and the third was a childcare worker (*barnskötare* in Swedish).

Use of field notes

Field notes have been used regularly in qualitative research to collect data based on observations and conversations. Full field notes can be made, such as verbatim transcripts of conversations taken by hand or recorded by a tape recorder, or brief notes made at the time can be elaborated on later (Thorpe & Holt, 2007).

Bryman (2012) identified three types of field notes: mental notes made when a situation suggests that it is inappropriate to take notes in writing at that time; jotted or scratch notes, taken at the

time of observation (by non-participant or participant observation) or discussions that consist of highlights that can be remembered for later development; and full field notes written up as promptly and as fully as possible. These last two types of notes require a way to be devised for how to create them. In my project, jotted notes were taken which would later be elaborated and would form the base for composing more thoughtful notes when I had time to reflect upon the observations. but while they were still fresh in mind. The purpose of my jotted field notes was to help me remember situations where I had been involved. This progressive structure of field notes provided me a way to preserve the details of observations so they were not forgotten or overlooked as I built my analysis. This approach was important in order not to lose what had been the focus of Article I when I wrote the analysis for Article III. It was necessary to avoid generalisations and to provide specifics. The specific focus of Article I was how children used measurement concepts.

Further to the information provided in the article, the field notes taken in my study may be classified as scratch notes. The researcher participated in the activity together with the group of children being studied. As Bryman (2012) stated, field notes are only useful to the extent that they record what can be remembered. Therefore, I systematically rewrote and elaborated on the notes after the activity. While justifying the use of field notes rather than video recording, I acknowledge the method has obvious limitations.

Nevertheless, field notes do not contain as much information as a video that could be watched multiple times. However, the field notes actually provided appropriate data to answer the research questions in the initial conference paper. And by not focusing on other details such as gestures, postures or eye movements, I was able to keep my focus on the actual words and actions of the children.

Another justification and reflection I need to state is my own role as researcher was well as participant in the interactions. Following Dunn's (2012) reflections on her research on girls' play, as a teacher with many years' of experiences working with children of this age, I believed that the children's trust could be gained if I joined the play session when invited. To do this, I needed to adopt an active player role within the play situation as the children defined it. Schwartzman's (1978, p. 329) insistence that "the study of play perhaps more than any topic, requires that researchers adapt themselves to the character of their subject, not the reverse"

was the stimulus for this choice. I understood, however, that the teacher role would need to be carefully managed – and that I should become involved only when invited.

Operationalising being and becoming as analytical tools

The analysis in Article II was to better understand the increased influence of schoolification on the curriculum identified in the potential tensions in the goals and guidelines of the revised preschool curriculum (Skolverket, 2011) could affect preschool teachers' planning of activities.

In order to identify what kind of socialisation the goals and guidelines were analysed in regards to whether the focus was on being and becoming. Definitions of being and becoming drew on James et al. (1998), Lee (2001) and Qvortrup (1994). The definitions of these concepts are described in Article II. A check of the analysis using these concepts was done in collaboration with Tamsin Meaney, my supervisor and co-author on this article. In Article II, quotes from the curriculum are exemplified as exhibiting the focus on being and becoming. These examples give others possibility to make sense of the interpretations that I made.

Re-analysis of empirical data

At the conclusion Article II, I suggest that more research is needed to understand how teachers' actual practices may affect children's opportunities for socialisation. Therefore, it seemed appropriate to re-examine what was in the original article (Lembrér, 2013), looking at how the children, the teacher and the researcher viewed the children's actions and discussions as examples of being or becoming a mathematician. New questions can be raised from re-analysing empirical material which a researcher collected for the purposes of a prior study (Bryman, 2012). A description of the re-analysis is provided in article III.

The field notes, allowed me to create reflective notes to identify, record and discuss being and becoming mathematicians. I made use of my idea of further research about operationalisation of mathematics activities in preschool.

Working collaboratively (with Tamsin Meaney) allowed me to describe and categorise this. This way of working forced me to see other perspectives of the interactions described in Article I. The collaborative co-analysis became a part of my licentiate studies, because I wrote Articles II and III with Tamsin. Re-analysis of interactions provided the opportunity to clarify my own thoughts about what I had seen and experienced. Using this method

highlights the crucial role the conversations play in addressing some of the limitations of working as a single researcher. Tamsin's questions in relation to the theoretical framework obliged me to revisit the connections between preschool, mathematics activities and processes of socialisation using the concepts of being and becoming mathematicians. This helped me to explore a broader understanding of mathematics education in the Swedish preschool which was an overall aim of my project.

Using a similar analysis to that of Lembrér and Meaney (2014), the field notes used in Lembrér (2013) were re-analysed to identify how the children's peers, teacher and researcher positioned them as being and becoming mathematicians. The dual role that I had as a researcher and teacher are discussed in the following section on ethics.

Ethical considerations

This research followed the ethical code of Swedish Research Council: the teacher held a conversation with each family to inform them about the purpose of the study; it was emphasized that all participation was voluntary, and the families could withdraw their children from it at any time. All participants were given fictitious names (Child1, Child2, Child3, Child4 and Child5) to ensure their anonymity, and the empirical material and notes stored in a manner that ensures integrity.

In an empirical study involving children, ethical issues must be considered. From the perspective of my theoretical framework, children are recognised as participants with the right to have their voices heard and to be taken seriously.

However, the manner in which I investigated on a specific area of mathematics in early childhood education was constrained by my being a preschool teacher. My initial role in the research was that of data collector, with the main purpose of observing the preschool activities, as discussed in Article I. What I captured there was just one representation of the activities as they occurred. In my role as a preschool teacher, capturing data was an important priority, a key challenge then being to switch my perceptions to those of a researcher. To address these dual demands of teacher and researcher, I refer to myself as "Dorota" in Article I and as "the teacher" in Article III.

As mentioned in the conference paper, the original dialogues in exchanges were in Swedish and were translated to English, which changed the form but not the content. In Article III, the original Swedish dialogues were also included.

PART TWO: STUDIES AND CONCLUDING DISCUSSION

5. INCLUDED ARTICLES

Overview of the articles

All three articles included were written over the period June 2012 to June 2014. During this time I continued my personal development as a researcher. As with all professional growth, it is easy to see now that the first article could have been improved. However, the three articles illustrate my growth as they identify different issues that arose as I reflected on each study.

The articles are presented in the order they were written.

Article I

Lembrér, D. (2013). Young children's use of measurement concepts. In B. Ubuz, Ç. Haser, M. A. Mariotti (Eds.) Proceedings of the Eighth Congress of European Society for Research in Mathematics Education (pp. 21482157). Ankara: Middle East Technical University.

This conference paper was presented at the Eighth Congress of the European Society for Research in Mathematics Education (CERME8) as a contribution to Working Group 13 (WG13), Early Years Mathematics (EYM). This group focused on the learning of mathematics by children aged three to eight and hence spans preschool to the early grades of primary school (although with a different transition age in various countries).

This article considered the importance of children's own interests and experiences, as starting points for activities in preschools – in this case by identifying their use of measurement concepts.

The children's own experiences provided the motivation and stimulus to provoke their mathematical thinking about quantifying

different attributes of objects. I conclude from this case that being allowed to draw on their own experiences allowed children to link their existing knowledge with knowledge about measurement concepts.

The field notes had limited opportunities to analyse other details of interactions, for example, eye contact between children. The specific focus was to capture what the children expressed through spoken language, gestures and with the help of toy vehicles (cars, trains) and other material (pen, paper).

Although the research produced some outcomes, further research is needed on how other mathematical concepts can be developed by preschool teachers drawing on children's outside-preschool experiences.

I

YOUNG CHILDREN'S USE OF MEASUREMENT CONCEPTS

Dorota Lembrér

Malmö University

This paper describes preschool children's measurement representations as they engaged in drawing a map. The use of small cars, boats, trains and aeroplanes helped the children to make the connections between two and three dimensional space. They also made connections to their awareness of length. The children's own experiences provided the motivation and stimulus to provoke their mathematical thinking about quantifying different attributes of objects.

INTRODUCTION

In this paper, I focus on children's experiences of area and different forms of length, such as breadth and height, by analysing the children's descriptions given while they were drawing a map. The children's own thoughts were used as a starting point to discuss the mathematics by myself, as the teacher. This case study is a part of a larger study which arose from a desire to understand how children's outside experiences can promote mathematical learning.

Doverborg and Samuelsson (2011) highlighted the need for children to learn from their own experiences in a way that made sense to them. Their research indicated how children perceived mathematics to be useful both at the current time and in the future. However, Uttal (2000) found that children's developing conceptions of maps were affected by their understanding of the surrounding world. Uttal suggested that younger children perhaps have not yet developed the ability to understand and connect their outside experiences to activities inside preschool. Uttal's study showed children's difficulties in encoding, remembering or understanding information. He suggested that to capture and comprehend all aspects of a three dimensional world on to a two dimensional sheet of paper is impossible for young children.

According to the Swedish preschool curriculum, early childhood settings should facilitate mathematical learning through play (Skolverket, 2011). Play has a leading role in developing children's knowledge from an early age (Vygotsky, 1933/1966). Activities can be based on a creative form of play, with opportunity for a variety of expressions. Children's everyday experiences can be represented in their visual creativity and provide opportunities for conversations. Nevertheless, it can be difficult to see children's illustrations with anything other than the adult eyes, but when we listen to children, as they draw, we can understand their thoughts, thus providing insights into their interests and background (Coates & Coates, 2006).

Social interaction in play can promote the construction of mathematical knowledge. Edo, Planas and Badillo (2009) stressed that teachers and children interactively construct shared meanings when engaging in activities, such as play. Consequently, the preschool teacher has to find meaningful situations and ways to communicate that

challenge the children to ask questions, reflect and discuss (Clarke, Clarke, & Cheeseman, 2006). The conversation between adults and children can be a part of the learning process in mathematics, where the teacher has a supporting role to help the children build an understanding of measurement.

When children attend preschool they bring with them experiences from outside preschool which can be the basis for developing children's mathematical thinking (Clarke & Robbins, 2004). However, teachers' perception that they must follow the curriculum can result in them providing activities suggested by the curriculum but which do not build on children's own understandings (Doverborg & Pramling Samuelsson, 2011).

MEASURING CONCEPTS USING CHILDREN'S OUTSIDE PRESCHOOL EXPERIENCES

Concepts of measurement are described in relationship to the concepts of attribute, unit and scale (New Zealand, Ministry of Education, 2007). The attribute that is compared can be area, length, volume and time, etcetera. Unit and scale measurement concepts can be applied to most attributes but initially it is very important for children to be able to identify what attribute is to be measured (New Zealand, Ministry of Education, 2007). Once the attribute is identified, children are then able to do direct comparisons by placing two objects next to each other. They also develop an understanding of transitivity, in which a third object is used to compare two other objects. If the first object is smaller than the third object but bigger than the second object, it is possible to say that the second object is smaller than the third object.

In measurement, units are used to measure an attribute and to quantify the amount of an object. Bush (2009) described children's understanding of measurement, with focus on usage of identical units and iteration. For an accurate measure, the units must be identical. Iteration is the repetition of a unit when measuring involves detailing an amount and is one of the underlying concepts connected to unit. Connected to the need to understand iteration, children also have to understand the idea of tiling, which is when units are placed repeatedly, with no spaces between. These are counted in order to find the measurement amount (Bush, 2009). Relativity involves understanding how units compare in size to other known objects (New Zealand, Ministry of Education, 2007). McDonough and Sullivan's (2011) research suggested that children also need to understand that a larger unit can be subdivided into repeated parts which can be counted, to produce a measurement of the object. This concept leads to the use of standard units, such as metres and centimetres.

When using a scale to measure, any point can act as the start or end point. However, without an awareness of the concept of unit, incorrect measuring can occur (McDonough & Sullivan, 2011). The concept of scale also includes an understanding that marks on a scale represent the end point of each of the units. Therefore, the end point when something is placed on a scale, indicates the amount in the same way that counting individual units does (New Zealand, Ministry of Education, 2007).

The Swedish preschool curriculum suggests that the preschool should engage children in activities that develop their ideas about measurement and space, as well as other mathematical concepts (Skolverket, 2011, p. 10). This means that teachers are responsible for building on children's understandings of attribute, unit and scale as they engage in an activity.

Children's everyday experiences outside preschool can be a starting point for building measurement strategies in preschools (Castle & Needham, 2007). Clarke and Robbins (2004) collected data that illustrated children's experiences at home and in their neighbourhood and showed a variety of mathematical contexts. For example, there were sequences of children measuring ingredients and cooking at home. These provided evidence of mathematics in everyday experiences, although they were not recognized by parents or teachers. Meaney (2011) also found that a six-year old girl engaged in a number of measurement activities at home, often associated with the child's physical engagement in a task. In particular, she suggested that measurement of time, often considered hard because of its abstract nature, was the focus of many discussions between the child and her mother. This contradicts suggestions that length is the easiest attribute to measure.

Fleer (2010) suggested that younger children in preschool probably are unaware of the value of their own experiences and the teacher has to encourage this awareness. Within preschools, there are possibilities for knowledge creation, nevertheless children should have the opportunity to form their own experiences and make choices in the light of these.

There appears to be little research which shows how children's share their previous measurement experiences and then teachers make use of them to develop their understandings. For example, Castle and Needham (2007) investigated younger children's understanding of measurement concepts, but not their thoughts about them. In McDonough and Sullivan's (2011) research, children were assessed on their preconceived understandings about how children learn length measurements.

The aim of my research is to understand how children's outside experiences can promote mathematical learning. Teachers' ability to recognize and work with children's outside preschool experiences can affect the mathematical activities that they offer to children. The research question is:

How do children use measurement concepts in an interaction that draws on their outside preschool experiences?

METHODOLOGY

This paper presents a case study which is a part from a larger study (Bryman, 2012). Over recent years, researching early childhood education by listening to and observing children has become common (Dockett, Einarsdottir, & Perry, 2009). A case study approach recognises that within social and cultural settings, children as competent participants have a right to have their voices heard and to be taken

seriously. The larger project investigates the relationship between children's outside preschool experiences and their mathematical learning in the preschool. In this paper, I present one episode in which I was involved as the teacher where children made connections to their outside preschool experiences whilst drawing a map. Their involvement showed use of many of the measurement concepts described earlier.

In order not to lose the spontaneous aspect of their play, field notes, first by myself, but later, after the children invited me into the play, by a colleague were made instead of, for example, video recordings. The latter would have provided the possibility to analyse the data several times. However, given that the wider project was about documenting naturally occurring incidences in a preschool setting, it was decided to use field notes instead.

Rather than being set by me, the activity began as a play session with a group of five children aged between two and six years before breakfast. It was the children, one boy in particular, who suggested drawing a map, which became the focus. From being an observer I became an active participant in the activity. I am aware that several of the questions that I asked had an impact on the dialogue sequences during the activity (Hasselgren & Beach, 1997). On the other hand, I was one of these children's preschool teachers and we interacted in ways that seemed typical of our normal forms of interaction.

Analysis of the interactions was done by looking for examples of the measurement concepts of attribute, unit and scale. Examples of the children's use of these concepts are provided in the next section. The exchanges were originally in Swedish but are provided in English. It is not always easy to translate young children's Swedish as their language is developing, so it has been tidied up in places to make it more understandable. This has changed the form but not the content.

CHILDREN'S STRATEGIES IN MEASURING WHILE DRAWING A MAP

The group of five children consisted of three boys and two girls. Child 1 is six years old, child 2 is two, child 3 and child 4 are both five years old and child 5 is four.

Child 1 handed out toy vehicles to the other children, at the beginning of this activity. During the activity, the children shared and swapped toy vehicles between themselves. They all had experiences about travelling and used their knowledge to draw the map. The dialogues show how the children used the toy vehicles with the measurement concepts of attribute, unit and scale.

The activity began with a boy picking up paper and pens. The following exchange then transpired.

- Dorota: Why did you take out the paper?
 Child 1: We must make space
 Dorota: Make space? What do you mean?
 Child 1: Space for boats, trains, cars, airport, roads, you can take busses.

Dorota: Are you thinking about a map?

Child 1: We will have roads, airport, harbour, train station. We will find it, we will draw on the paper.

By saying “we must make space”, Child 1 appeared unclear about which attribute he was talking about. However, he clarified this by saying that space was needed for the toy vehicles, suggesting that it was area. After that he said “we will find it”, which was followed by looking at the toy vehicles and the sheet of paper. This suggests that the child was making a visual estimation of the different amounts of area that would be needed for roads, airport, harbour, and etcetera. However, there is no explicit comparison mentioned either between the different vehicles or between the vehicles and the space on the paper. If there is a comparison, it is implicit. This is similar to what Meaney (2011) found in her study of a six-year old child’s use of measurement concepts. In this study, many of the comparisons were to an unidentified other, making them also implicit.

Later Child 4 helped a younger boy, Child 2, to count busses and draw train stations. Then Child 4 had an idea about drawing a railway and two train stations. She described this to Child 2. Child 4 had experiences of travelling by train and, therefore, may have known that trains travelled from one station to another, although she did not explain why she needed to have two train stations.

Child 4: We are drawing roads and two stations.

Dorota: Why two stations?

Child 4: I do not know, but the train has to go somewhere (Looks at child 2. He had trains, which he gave to her)

The child used physical objects to visualise her thoughts. By saying that the train has to go somewhere, Child 4 implies a comparison between the area taken up by a train, and more implicitly its journeys, and the area on the piece of paper. The presumption seemed to be that the paper had a large enough area to cater for the railway line so the train could “go somewhere”. Child 4 placed the two trains side by side and used them to draw lines on either side of this pair. Then, she moved the trains forward and drew new lines, again either side of the pair of trains and repeated this three times. After that she drew the rest of the railway without using the two trains. She had designed a railway across the paper. Each train had the role of an identical unit, as each train was the same width. In placing the trains side by side, there was no gap between them, suggesting that this child understood the unit concept of tiling. In this way, Child 4 determined the width of the railway from using the toy trains. After that, she drew a station at each end. This may indicate that she was using them as end points for the length of the railway line, which is related to concept of scale.

The next example shows Child 5’s explorations about width, from putting two vehicles side by side and using his experiences and knowledge about traffic and directions. Child 5 started by drawing a road, which he linked to the train station.

Child 5: How much space do I need? I want to have a two-lane street, so my car can drive in both directions.

Dorota: What do you think? How much space does your car need, how wide is the car?

He looked at the car and drew a straight line beside it. He moved the car sideways, and drew another line. The street was compared to how wide the car was. Child 5 used two identical units, the cars, and put them side by side on the road, to see if they fitted into the space. By doing so, he subdivided the width of the road in order that the cars could drive in both directions. The cars were placed side by side with no gaps between, indicating tiling. He estimated the width of the road by placing these cars together in a similar manner to what Child 4 had done with the trains.

The next exchange shows again the importance of the toy vehicles in supporting the children's measurement representation so that they could draw the map as they wanted it to look. The toy cars were not only used by Child 5 to draw roads of an appropriate width, but also to draw a line in the middle of the road.

Dorota: What are you doing?

Child 5: Dividing the road so the cars know on which side of the road they should drive. You know when you drive you should have this line there (pointing at the line, he drew in the middle of the road)

Dorota: Here! On the left side of the car (pointing on the line in the middle)

Child 5's experiences outside of the preschool made him aware the road should be designed so the cars knew on which side of the road they should drive. He placed two cars side by side. Then he took away one and drew a line. These two cars represented the width of the road, which can be considered as a single unit in its own right. In this case, the cars could be seen as supporting the partitioning of this large unit of a road into smaller units, the width of one car. Being able to move backwards and forwards between seeing the car or the road as the unit provides a way of seeing the complex relationship between them.

The follow exchange illustrates how child 4, the girl who drew the railway, began to draw a harbour. The harbour was needed because, as the children discussed, it was possible to travel by boat. Child 4 took a pen and drew a line in front of a boat, then she put another boat behind the first and repeated this until she has five boats, lined up one behind the other, like cars parking in a street, and drew two lines. She said:

Child 4: I'm drawing a harbour, I place my boats behind each other and I have five boats. I have to draw all five to get space

Dorota: Do you make space for your boats?

Child 4: Yes, I know how large a harbour should be now

Dorota: How do you know?

Child 4: My first boat is behind this line (she points) I have drawn two lines now, you see (she takes away the boats and points on two lines)

Dorota: Okay, a line in front of the first boat, and a line behind the fifth boat

Child 4 uses the boats, as physical objects, to find out and measure the area needed for the harbour. To do this, she builds of the attribute idea of comparison, by using length as a default for area measurement. The iteration is of five boat lengths, which forms the area of the harbour, when boats are placed one after the other. Similar to when she was drawing the railway line, child 4 used five identical units and filled a space without gaps, suggesting the unit concept of tiling. By drawing a line at the end of the last unit, she identified the end point for her measurement, which is for a component of the concept of scale. As the teacher, I took the opportunity to use ordinal terms, “a line in front of the first boat, and a line behind the fifth boat” to highlight these endpoints.

A discussion with children in relation to measurement occurred again when the children tried to draw streets and a runway for an aeroplane. The children used each other’s ideas to work out how they could make enough space on the paper for vehicles. Child 1 and Child 3 noticed what Child 5 did when he drew roads and did the same with the runway for aeroplanes.

Dorota: How is it going? Do you have space for all the planes?

Child 1: We have five aeroplanes and only two can be in air.

Dorota: Be in the air?

Child 1: One lands, and one lifts off (he points to the map), you see, we have drawn a take-off and landing runway. Other planes are here.

Dorota: Okay, what were you thinking when you drew the runway?

Child 1: The aeroplane takes a lot of space, we have tried.

The children needed the support of physical objects when, for example, they discussed the width of a runway to make sure it would be possible to fit an airport on the map. Child 1 took two aeroplanes and placed them on the runway, side by side. In this way, he compared the width of an aeroplane to the width of the runway. By placing two aeroplanes on the runway side by side, Child 1 and Child 3 used the concept of iteration, to measure the width of the runway—it was two aeroplanes wide. They used aeroplanes to determine the size of the area that they had to draw, by lifting one aeroplane and landing the other.

Sometimes physical objects were not sufficient for developing some ideas and it was myself, as the teacher, who provided the stimulus. When it was time to draw a bridge, I challenged them to think more about height and width. To begin with, I took a piece of paper and said “how long should the bridge be?” A girl replied, “as long as a car”. Then I cut a piece of paper, so that it was as long as the car the girl gave to me.

- Dorota: Is it a bridge? (I looked at Child 4. who put the piece of paper on the map), is it a bridge?
- Child 4: No, how should we make one? What should we do?
- Dorota: (took a larger piece of paper, gave it to child 5) Can you cut out a strip, which has the same width as this piece (the piece child 4 cut, which was too short). It is as wide as two cars. This has sufficient width to be a road in two directions.
- Child 4: We take two cars, put them on the piece of paper, one after the other. Is it enough?
- Dorota: How do we know that the bridge has enough width and height to allow a train to drive under?
- Child 5: A train must be able to drive under the bridge, we try (teacher takes a train, holds up the piece of paper and pushes it upwards until there is space enough to drive the train under it.)

Child 4 together with child 5 wanted to build a bridge for cars to drive over and trains to go under. The width of the paper was compared to the width of two cars. Child 4 said “we take two cars, put them on the piece of paper, side by side and cut”. In placing two cars side by side, they showed a concept of iteration. The cars were identical units and these units filled the space without gaps, thus tiling was used. Relativity in measurement takes place, when they needed to cut a piece to fit two kinds of units, cars and trains. The piece of paper, the cars and trains, are compared directly.

DISCUSSION AND CONCLUSION

This activity was initialized by the children and the map was a product of their engagement. To produce the map, the children used several measurement concepts to solve problems. I consider the children’s creativeness, in map making, to be the key for making connections between their ideas about how to measure the spaces they wanted on their map and the measurement concepts described in the literature (Bush, 2009; New Zealand Ministry of Education, 2007; McDonough & Sullivan, 2011). The children used informal units, such as the toy cars, boats and places, to measure attributes of objects, such as the area for a harbor, the width of a road, height of a bridge and length of the airport runway.

The results of this study indicate that children’s own experiences were the background for the activity and could be drawn upon whilst they were playing. Using their own experiences allowed them to link the knowledge they possessed with knowledge about measurement concepts. The activity allowed them to be creative. At times, they were not able to express their thoughts verbally but did so through gestures, when they were using the physical objects.

As a teacher I could recognise the mathematics in children's actions and drew their attention to concepts of measurement, especially in the bridge episode. I could help children to address challenges they had when building the bridge. The knowledge that the children had about the need for the bridge to be tall enough for a train to go under it and wide enough for two cars to travel on it provided them with background to what the problem was that they had to solve. Their understanding of what the problem was meant that my questions prompted them to think again about how long the paper for the bridge needed to be.

As Doverborg and Pramling Samuelsson (2011) stressed there is a need to use children's own experiences as a basis for their mathematical activity. In this case study, children's outside preschool knowledge about travelling and their experiences with cars, trains, aeroplanes and boats allowed them to use and develop understanding about measurement concepts. This illustrated how Doverborg and Pramling's ideas could become a reality when children are supported to discuss their ideas. As the teacher, by engaging in their play, I confirmed the value in these experiences through the social interaction and promoted the construction of mathematical knowledge. In many ways this was similar to what was documented in Edo, Planas and Badillo's (2009) research. Listening to what the children had to say contributed to finding a meaningful situation, in which it was possible to challenge the children to ask questions, reflect and discuss (Clarke, Clarke, & Cheeseman, 2006).

Further research is needed to understand how children's background knowledge can be used by preschool teachers in activities and discussions. The research described in this paper has shown how concepts of measurement can be used but further research is needed about how other mathematical concepts can be developed by preschool teachers drawing on children's outside preschool experiences.

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Article II

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This journal article was published in *Educare*, a journal produced since 2005 by the School of Teacher Education, Malmö University. *Educare* is a Nordic research forum for faculty, practitioners and policymakers.³

In this article, we considered socialisation to be the process by which children acquire the skills necessary to perform as functioning members of their society. We linked socialisation processes with two components: the first, the reproduction of culture from one generation to another; the second, to recognise that young children in preschool need to be seen as knowledgeable and active participants in today's society. We therefore analysed the goals and guidelines of preschool curriculum. Our purpose was to investigate whether preschool children needed to be recognised as involved in the construction of their own childhood and experiences, as a product of what preschools and the adults working in preschools should provide to them. The concepts of being and becoming were chosen as analytical tools to investigate tensions between these two components: production of knowledge and skills and the reproduction of norms and values. These included in socialisation processes are linked to the global issue of schoolification and early mathematics education. When an increased focus on mathematics in the revised curriculum, mathematical goals are analysed and compared with the other goals and guidelines to highlight the understanding of mathematics education in Swedish preschools.

The findings suggest that the goals and guidelines are in conflict in different sections of the curriculum. The mathematical goals have a strong emphasis on preschool children becoming mathematicians, which may restrict teachers' options in planning activities to value what children already know and can do. This may be considered an example of schoolification, where the kind of socialisation preschool children receive is restricted to ensuring that they become the kind of mathematicians needed for school learning.

³ For more information about *Educare* see <http://www.mah.se/fakulteter-och-omraden/ls/Nyheter/Publikationer/EDUCARE---Vetenskapliga-tidskrifter/EDUCARE--Scientific-Journal/>

II

Socialisation Tensions in the Swedish Preschool Curriculum – The Case of Mathematics

Dorota Lembrér and Tamsin Meaney

In Sweden, where almost all children attend preschool, preschools are significant sites of socialisation. Therefore, there is a need to investigate how this socialisation may be affected by implementation of a revised curriculum. Changes in preschool curriculum are an indication of how schoolification is influencing Early Years Education. This is because preschool teachers and work teams use the curriculum to plan activities for children who will be socialised by participating in these activities. This article investigates the goals and guidelines in the revised preschool curriculum and considers how an increased emphasis in those related to mathematics may affect the kind of socialisation children could gain. The goals and guidelines support teachers' pedagogical practices and hence are worth investigating. The concepts of being and becoming are used to consider how the goals and guidelines position children as having or needing to gain norms and values, skills and knowledge. Consequently, they are considered to need to acquire the skills to perform as members of their society or as knowledgeable participants when constructing their everyday lives in preschool. The goals and guidelines related to mathematics emphasise children's becoming, and thus their incompleteness. This results in less opportunity for teachers to perceive children as having relevant experience and skills to contribute to activities and to produce creative cultural understanding. Consequently, the schoolification of the preschool curriculum through the increased emphasis in the goals and guidelines for school subjects is likely to affect the kinds of activities that preschool teachers plan and provide to children, and thus the kind of socialisation they receive in preschool.

Keywords: becoming, being, curriculum, mathematics education, socialisation.

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Introduction

In this paper, we investigate how the increased emphasis in the goals and guidelines in the revised preschool curriculum related to mathematics education could affect preschools' perceptions of the kind of socialisation that young children need. The revised preschool curriculum, implemented in July 2011 has a more intense focus on learning and knowledge (Vallberg Roth, 2011) suggesting that it is more focused on the knowledge needed for school than the earlier version (Tallberg Broman, 2010). These changes reflect the main reasons given for the revision of the curriculum: enhanced professional education and strengthened pedagogical practice (Utbildningsdepartementet, 2010), and they follow a global trend in the "schoolification" of preschool (Alcock & Haggerty, 2013; Garnier, 2012; Sofou & Tsafos, 2010).

Although the actual number of goals and guidelines that preschools or the work team are encouraged to develop in children, which specifically mention mathematics remains the same (Skolverket, 1998; Skolverket, 2011a), the revised curriculum background document links others to mathematics (Utbildningsdepartementet, 2010). In the background document, mathematics is also one of three content areas (the others are language and science and technology) which are specially discussed and clearly related to subjects taught in compulsory school (Skolverket, 2011c). Therefore, it is important to problematise the increase in the "schoolification" of the formal preschool curriculum and how this may affect municipalities, preschools and teachers in planning activities to meet these goals and guidelines as well as "the needs and interests which children themselves express in different ways" (Skolverket, 2011a, p.12). Researchers have noted for some time that curricular changes can result in tensions for teachers in their planning which can affect what is then offered to children in activities (Cuban, 1990; Reys et al., 2006). Delacour (2013) highlighted that teachers' interpretations of the changes in the Swedish preschool curriculum could result in children seeing and using mathematics differently.

Discussions about the role of mathematics education in preschools have gained prominence in the last two decades (Barber, 2009; Perry, Young-Loveridge, Dockett, & Doig, 2008). This is partly because an analysis by Duncan and colleagues of six longitudinal studies suggested that early mathematics knowledge is the most powerful predictor of later school learning including the learning of reading (Duncan et al., 2007). However, Swedish researchers (see for example Doverborg & Pramling Samuelsson, 2011) highlight concerns about the value that institutionalisation gives mathematics

because this valuing may constrain teachers from being able to see aspects of mathematics outside the frame of the curriculum. In Björklund's (2012) research, she identified mathematical terms that should be used in the preschool activities. Her research then considered how teachers used the terms in the activities that they planned. This provides an example of the value that can be given to mathematics and the impact it can have on the activities children are to engage in. It is also an example of how teachers can be constrained by choices made by others about the appropriate knowledge and skills they should instil in children, potentially restricting their ability to see aspects of mathematics outside the frame of the preschool curriculum.

With the introduction of the revised curriculum, it seems valuable to investigate what, if any, tensions could occur with the increased focus on mathematics as one of the content areas that preschools or the work team have to now pay attention to. Therefore, our research question is: Does the increased influence of schoolification on the curriculum produce tensions that are likely to affect preschool teachers' perceptions of the activities that they should provide to children?

We begin by discussing socialisation, before linking these ideas to the concepts of being and becoming. This is followed by an analysis of how the concepts of being and becoming appear in the preschool curriculum.

Socialisation

As reflections of the socialisation process, educational institutions such as preschools provide insights into the meanings valued by a society (Walzer & Miller, 2007). Socialisation is a process by which children acquire the skills necessary to perform as functioning members of their society (Biesta, 2007). We suggest that this involves both reproducing culture from one generation to another to ensure that societies sustain themselves over time (James, Jenks, & Prout, 1998) and producing new ideas and culture through learning to be creative (Ebrahim, 2011). For this second component of socialisation to occur, preschool children need to be recognised as being knowledgeable, active participants in the construction of their childhood and their experiences (James et al., 1998).

Our definition draws upon Biesta's (2007) distinction between socialisation and education. He considered socialisation to be the "insertion of 'new-comers' into existing cultural and socio-political settings" (p. 26). For him, much of what occurred in institutional settings of education was actually socialisation. In contrast, education as defined by Kant was about the self-

education needed to achieve rational autonomy to become fully human. However, as Biesta further argued, this view of education could be considered a form of socialisation because it sets up what the end product of self-education had to be: rational autonomy. Thus, education of this kind also contributed to newcomers taking on the attributes of existing members of a society; those who did not have or did not gain these attributes were unable to be considered human. For example, Lee (2001) discussed how a young child's age affected adults' perceptions of their having the right to hold opinions and desires, as a child's age has often been taken to mean that they are not worth listening to. Discourses such as these within a dominant framework make it difficult to recognise children as fully human or people in their own right (James & Prout, 2001). Biesta (2007) postulated that education would be better considered as preparation for an uncertain future; he states that freedom "needs to be realised again and again" (p. 32). Adulthood in the twenty-first century is less stable, uncertain, and thus unpredictable, with stabilities such as having the same job not expected to last for a person's lifetime. Lee (2001) suggested that to reflect this reality, conceptualisations of childhood need to accept and respond to this uncertainty. In so doing, new definitions of what it means to be human can be produced (Biesta, 2007). Consequently, young children could be considered social actors in their own right, not in comparison to adults (Ebrahim, 2011).

In our definition, rather than distinguishing between socialisation and education as Biesta did, we consider preparation for an unknown future to be related to the production component of socialisation. This is line with Ebrahim (2011), who defined socialisation as the process by which people who inhabit a society create it. Thus it is possible to consider children constructing their own childhood and experience as a form of preparation for an unknown future. Research such as Markström and Hallden's (2009) showed how children in preschool influence and shape their everyday lives as active agents. A choice is not made for children about what their childhood should be; rather, children are supported in being creative in producing new ideas and culture as their future unfolds. As James et al. (1998) state, "Childhood diversity considers the infinite variety of the social context in which children live, leading to a deconstruction of childhood's conventional, singular and reductive form" (James et al., 1998, p. 34).

Socialisation can be considered to both reproduce and produce (a) norms and values and (b) skills and knowledge. With societal differences in valuing each of these two components and of different aspects within each compo-

ment, the nature of socialisation has been contested. For example, Lee (2001) considered socialisation to be predominantly about reproducing norms and values. However, he acknowledged that societies are made up of many different groups; often, the ideals that individual groups wish to pass on to the following generations are in conflict.

Trondman (2009) considered it unreasonable to talk about childhood without looking at the environment that includes children's multiple worlds, including home and preschool. Within each of these worlds there are structures and expectations which contribute to the development of norms and values. These strive to shape children, to fix them into "standard" patterns, which may limit their enjoyment and creativity but on the other hand create stability (Prout, 2005). However, within these same worlds, there are different kinds of opportunities in which children can produce knowledge and understanding about their lives (Ebrahim, 2011). For Trondman (2013), in problematising the institutionalisation of children's socialisation through the preschool curriculum, the question becomes one of how institutions produce pedagogical practices that recognise and build on the multiple worlds in which children live. The preschool curriculum, as a document representing different views of socialisation that young children should receive, is likely to contain contradictory goals and guidelines that preschool teachers will need to resolve when planning activities.

Being and becoming mathematicians: the schoolification of preschool

In order to understand how an increase in the number of goals and guidelines connected to mathematics may affect the tensions between the production and reproduction components of socialisation, we have chosen to consider them in regard to children's being and becoming (Lee, 2001; Trondman, 2013). James and Prout (2001) suggest that childhood provides an interpretive frame for understanding the early years and thus needs to be understood as a social construction. Thus, a consideration of how the curriculum constructs children's childhoods in regard to their being and becoming is one way of identifying the tensions that may occur in the general goals and guidelines and how these differ compared to the tensions in the mathematics goals and guidelines. The concepts of being and becoming focus the analysis on the child, rather than on the adult's role in the socialisation process. The goals and guidelines describe what preschools and the adults working in preschools should provide to children. Categorising the goals and guidelines

according to how they reflect children's being and becoming provides a way of describing potential tensions in children's socialisation that could be connected to the schoolification of the revised preschool curriculum.

The concepts of being and becoming have been used by researchers in different ways and are a product of historical development, arising from different perceptions of children as being either incomplete or active independent agents. From this perspective, both children and adults can be considered as having a multiplicity of beings and becomings (Prout, 2005).

According to Lee (2001), the concepts of being and becoming separate the complete and independent child from the incomplete and dependent child. Qvortrup (1994) suggested that children's "being" is about being stable, complete, self-processed and self-controlling, capable of independent thought and action and, as such, possessing an independence that merits respect. For James et al. (1998), a process of socialisation where agents are active, knowledgeable, and skilled is in line with the "being" view of young children (James, Jenks, & Prout, 1998). For Ebrahim (2011), being situates young children as knowledgeable, intentional and skilled actors, who use skills and strategies to create their own childhoods. Consequently, we consider the concept of being to be related to the production aspect of socialisation.

On the other hand, "becoming" is about being changeable and incomplete and lacking the self-possession and self-control that would allow the child independence of thought and action (Qvortrup, 1994). A child who is becoming is incomplete (James et al., 1998). This concept is in alignment with childhood being considered a journey towards a clear and knowable destination of adulthood, with children's present lives and activities seen only in terms of how they contribute to a preparation for these futures (Lee, 2001). Adults expect children to one day "take over"; so adults need to understand and know what is needed to secure this future for their children. Upon successful and orderly completion, the child's future is as an adult being. Consequently, we consider children's becoming to be about the reproduction of society's norms and values, skills and knowledge.

However, being and becoming can be considered as two parts of the same socialisation process. Uprichard (2008) stressed that being and becoming should not be separated because children and adults present and future are combined in everyday situations. Taking being and becoming together does not make a difference between a child and an adult. Therefore, being and becoming can be considered complementary rather than in opposition to

each other (Prout, 2005), and promoting a difference between them may not be useful (Uprichard, 2008).

In regard to an increase in the schoolification of the revised curriculum, we needed in this study to consider what being and becoming a preschool mathematician might be. Consequently, we considered that being a mathematician would be indicated in the goals and guidelines by a recognition that children already brought with them to new activities some mathematical norms and values, skills and knowledge. These would then be available in regard to making decisions and expressing their ideas in a creative manner. On the other hand, goals and guidelines that situated children as becoming mathematicians would indicate the norms and values, skills and knowledge that children would need to gain for their future.

Method

In the Swedish preschool curriculum, there are goals that “the preschool should strive to ensure that each child” (Skolverket, 2011a, p. 8) develops or otherwise experiences. There are also guidelines that “preschool teachers are responsible for ...” and “the work team should ...” (Skolverket, 2011a, pp. 8–9) in relationship to the experiences that children should have and the purposes for those experiences. Thus, the goals and guidelines do not list what children should achieve but describe what preschools, preschool teachers and other adults working in the preschools should do, in regard to the kind of opportunities provided to children. Therefore, in order to identify what kind of socialisation the curriculum is promoting with a particular goal or guideline, we identified whether the focus was on production or reproduction by comparing how they were expressed with definitions of being and becoming, following James et al. (1998), Lee (2001) and Qvortrup (1994).

The goals and guidelines in the Swedish preschool curriculum document (Skolverket, 2011a) begin in Section 2.1 with “Norms and Values”. Section 2.2 is titled “Development and Learning” and the final section that we considered (2.3) is titled “Influence of the Child.” We separated the goals and guidelines about mathematics from the other goals and guidelines, which we labelled “general”. There are 57 general goals and guidelines and four others that are clearly linked to mathematics in the preschool curriculum.

Each of the 61 goals and guidelines in these three sections were examined in their entirety to identify whether and how they referred to children’s being and becoming. Children’s being was considered to be the focus of a goal or guideline if it discussed children shaping their own childhood experiences or

using their agency. For example, goals and guidelines that highlighted what children already possessed as valuable, such as children having agency to make decisions, express opinions, were considered as inferring that children's being was important.

Other goals and guidelines were considered to be about children's becoming if they inferred that children needed to gain a specific body of knowledge, or needed stimulation and opportunities for developing certain skills. For example, goals and guidelines which suggested that children needed to develop certain skills were considered as positioning children as incomplete with regards to knowledge and behaviour. This was because these kinds of goals and guidelines highlighted what children needed to gain; hence they were considered to be about becoming. We also examined the goals and guidelines for mathematics education in the curriculum. We then compared the socialisation emphases of the general goals and guidelines with those of the mathematics education goals and guidelines. This indicated whether an increase in goals and guidelines about mathematics was likely to increase tensions already in the general goals and guidelines and thus affect the socialisation that preschools provide to children.

The original version of the preschool curriculum is in Swedish (Skolverket, 2011b). However, Skolverket (the Swedish National Agency for Education) also produces an official English translation. Although a literal translation is never possible with documents of such complexity as curricula, our intention in the analysis was to examine the intention of the goals and guidelines in regard to their emphasis of children's being and becoming. Therefore, it was considered appropriate to analyse the English version as the intention of the goals and guidelines were unlikely to have changed, regardless of the language they were written in.

Being and becoming in the general goals of the curriculum

In this section, we discuss how the Swedish preschool curriculum positions children in regard to their being and becoming. Table 1 provides information on the number of goals and guidelines that seem to focus on children's being and becoming. As mentioned in the method section, 61 goals and guidelines were categorised (57 general and 4 specific to mathematics), based on definitions of being and becoming drawn from James et al. (1998), Lee (2001) and Qvortrup (1994).

As is noted in Table 1, four general goals were considered to be simultaneously about children's being and becoming, while six goals were not di-

rectly related to children. This is because all goals were about what the preschool, preschool teacher or work team were required to do and not about what children were supposed to achieve. An example of a goal which was considered as not being about either being or becoming was “co-operate with the home concerning the child’s upbringing, and discuss with parents the rules and attitudes in the preschool” (Skolverket, 2011a, p. 9).

Being	Becoming		Being and becoming simultaneously	Not related	Total
	Developing skills	Providing stimulation & opportunities			
12	22	13	4	6	57

Table1 *Categories and numbers of general goals and guidelines in preschool curriculum*

From Table 1, it can be seen that the majority of goals in the curriculum were about children’s becoming, in particular the skills that children needed to develop. There were also many goals and guidelines about the stimulation and opportunities that children needed to receive.

Positioning children as being

Examples of the goals and guidelines that position children in term of being were “give children the opportunity of understanding of how their own actions can have an effect on the environment” (p. 11), “express their thoughts and views, and thus have the opportunity of influencing their own situation” (p. 12). These examples of goals and guidelines also indicate how preschools should encourage children to use preschool contexts to influence their own situation, the environment and activities. Goals and guidelines related to being also indicate to preschools and adults that children should be respected when they participate in activities in the group. This can be seen in the guideline that children “are provided with the opportunities for learning and development and at the same time are encouraged to use the whole range of their abilities” (p. 11). Preschools are expected to use a pedagogical ap-

proach in which activities should be based on children's experiences, interests, needs and views. This can be seen in references to "sense of enjoyment meaningfulness in learning" (p. 11), "desire and enjoyment to learn" (p. 11) and "work towards ensuring that both girls and boys have an equal measure of influence" (p. 12).

The goals and guidelines also present children as being social agents who can influence and shape their everyday lives in preschools (Ebrahim, 2011). For example, "Preschool teachers are responsible for all children having real influence over working methods and contents of the preschool" (p. 12) indicates that children should be considered as active agents who have skills and knowledge that can be used in activities. Children also are positioned as having rights to be considered independent and capable, not as immature adults who need to gain skills and judgment. An example of this is the guideline for the work team to "take advantage of each child's ability and desire to take greater responsibility for themselves and their participation in the group of children" (p. 12). Another guideline, to "take account of children's eagerness, desire and enjoyment to learn, as well as strengthen confidence in their own ability" (p. 11), calls for children's present capabilities to be applied. The goals and guidelines that focus on children's being suggest that children who inhabit a society create it.

Positioning children as becoming

There are many more goals and guidelines that seem to position children as becoming, so we divided the analysis into two categories: "developing skills" and "providing stimulation and opportunities" to children.

Examples of the first category are the goal to "develop an understanding that all persons have equal value independent of social background and regardless of gender, ethnic affiliation, religion or other belief, sexual orientation or functional impairment" (p. 8) and the guideline to "prepare the children for participating in and sharing the responsibilities, rights and obligations that apply in a democratic society" (p. 12). These goals and guidelines indicate that children are conceived as individuals needing to be socialised by acquiring the necessary skills to perform as functioning members in society. Other goals and guidelines affirm that Swedish preschools have obligations to prepare children for the journey towards adulthood by providing them with appropriate skills. Examples of these include "ensuring that the individual child develops the ability and willingness to take responsibility and exercise influence in the preschool" (p. 12), and the guideline to "give child-

ren the opportunity to become familiar with their own immediate environment and those functions which are important in daily life, as well as become familiar with local cultural life” (p. 11).

Other goals and guidelines that were categorised as becoming in relationship to skills included: “develop their motor skills” (p. 10), “develop their curiosity and enjoyment” (p. 9), “develop their ability to listen, reflect and express their own views” (p. 9), “develop the ability to accept responsibility for their own actions” (p. 12), “to distinguish, explore, document, put questions about and talk about science” (p. 10), “to identify technology in everyday life, and explore how simple technology works” (p. 10), and “to build, create and construct using different techniques, materials and tools” (p. 10). The goals and guidelines indicate that children are considered to be becoming, because they position children as incomplete who need opportunities to be developed so that they resemble adults and have the skills to cope in adulthood at the present time. The abundance of goals and guidelines connected to skill development in regard to children’s becoming reflects Swedish society’s need for children to develop appropriate skills and knowledge (for example, technology or science) even during their preschool years. When the curriculum was revised, it was not just the goals and guidelines linked to mathematics which were given more emphasis, but also those connected to literacy, science and technology. These goals and guidelines suggest that children’s lives are determined and/or constrained by adults.

The other category of “becoming” goals and guidelines focuses on the stimulation and opportunities that children need as part of their becoming. Most of these, such as “their interest in science and technology” (p. 11), and “their language” (p. 11) were found in the “Development and Learning” guidelines (Section 2.2). They similarly positioned children as needing to acquire what others in society had deemed necessary for them to learn.

Positioning children simultaneously as being and becoming

Prout (2005) argued that differences between being and becoming are no longer possible to justify as both children and adults should be seen as a multiplicity of becoming, where all are incomplete and dependent. Thus, rather than concepts of being and becoming operating in opposition, children’s own experiences can be seen as valuable for widening the opportunity for learning norms and values, skills and knowledge, in a way that allows for both the production and reproduction of culture from one generation to another (James, Jenks, & Prout, 1998).

Three of the goals and guidelines in the Swedish preschool curriculum suggest that children's experiences should be recognised and used in pedagogical practices to gain designated norms and values, skills and knowledge. When both children and adults are considered in the curriculum to be knowledgeable, then what they bring to an activity can be considered as beneficial for each other's learning and creating. An example of a guideline reflecting this is that children "receive new challenges that stimulate enjoyment in learning new skills, experiences and knowledge" (p. 11).

Tensions in the general goals between viewing children as being and becoming

In the general goals and guidelines, children are either positioned as being with norms and values, skills and knowledge that could contribute to an activity, or as becoming where they are incomplete. Children were much more likely to be positioned as being in the goals and guidelines in the sections on norms and values (2.1) and the influence of the child (2.3). It is perhaps not surprising to find that this is the case and that children are more likely to be positioned as becoming in the section on development and learning (2.2). However, this distinction in the goals and guidelines that preschools and their staff are supposed to implement means that it was very rare to find goals and guidelines in which children are simultaneously viewed as being *and* becoming, where their present norms and values, skills and knowledge can be used in creative ways for both the production and reproduction of cultural understandings about the world. In the next section, we consider how the goals and guidelines related to mathematics position children.

Curriculum positioning of children as being and becoming mathematicians

As mentioned in the introduction to this article, the revised preschool curriculum has increased the attention to mathematics. For example, preschool teachers are to ensure that children are "stimulated and challenged in their mathematical development" (p. 10), in which development suggests lifelong learning. In this way, children are positioned as being on a journey towards adulthood. The goals that the preschool curriculum background document considers to be related to mathematics are that preschools should strive to ensure that each child:

develop their understanding of space, shapes, location and direction, and the basic properties of sets, quantity, order and number concepts, also for measurement, time and change,

develop their ability to use mathematics to investigate, reflect over and test different solutions to problems raised by themselves and others,

develop their ability to distinguish, express, examine and use mathematical concepts and their interrelationships,

develop their mathematical skill in putting forward and following reasoning. (p. 10)

This suggests that in planning mathematical activities, teachers are likely to focus on the skills and knowledge that children do not presently possess. The only goal that seems to recognise children as being capable of action, although at the same time needing to develop their skills is: “putting forward and following reasoning”. By suggesting that children are already capable of putting forward reasoning, children are positioned as being. In joining this to what children need to develop, this goal can be considered as simultaneously positioning children both as being and becoming.

The revised curriculum’s strong emphasis on becoming a mathematician does not support teachers in planning activities to value what children already know and can do. Apart from the half of one goal, it does not seem there are any possibilities for teachers using the curriculum to view children as being mathematicians. This also means that the curriculum does not support opportunities for children to produce childhoods in which mathematics plays a creative role in producing new cultural understanding.

The schoolification of the Swedish preschool curriculum

Preschool as an institution is framed by and organised through its norms and values, as highlighted in the curriculum (James & Prout, 2001). In recent years, there has been a worldwide trend to bring aspects of school down into preschools, a development which is likely to change the kind of socialisation that preschools provide to children. This schoolification of preschool not only reflects that young children are more capable of engaging in the learning than had previously been taught in schools but also situates children as being at risk of school failure if they do not arrive at school with expected

norms and values, skills and knowledge (see, for example, Clements & Sarama, 2007). Sweden can be considered to be on the soft end of the schoolification of the preschool process as the goals and guidelines remain focused on what the preschool and its staff should make available to children, not what children should achieve. It is also the case that in the revised curriculum there are only five goals and guidelines related to mathematics. However, compared with the previous version of the curriculum, the number of goals, particularly in the section on learning and development has increased significantly, mostly in regard to knowledge areas such as mathematics, literacy, science and technology.

In this study, we analysed the goals and guidelines of the curriculum from the sections on norms and values, development and learning, and the influence of the child in order to investigate whether teachers were likely to have to resolve tensions between seeing children as being or becoming. In particular, we wanted to see whether the goals and guidelines related to mathematics, as an example of a schoolification process, might be in conflict with general goals and guidelines.

In the two sections on norms and values and the influence of the child, it is possible to see children positioned as both being and becoming. This suggests that teachers are likely to provide activities that socialise children both as reproducers and as producers of cultural understandings. In contrast, in the development and learning section, which includes the mathematics goals and guidelines, the focus almost completely situates children as becoming. This means that teachers are not supported in their view of children as having norms and values, skills and knowledge, which could be of value in planned activities based on these goals and guidelines. Consequently, the kind of socialisation that children receive is restricted to ensuring that they become members of the current society. In particular, the increased emphasis in the goals and guidelines in the revised curriculum related to mathematics indicates the importance placed on ensuring that children begin to become mathematicians while at preschool, but it continues to situate them as incomplete.

In three of the general goals and guidelines and in one goal related to mathematics, children are situated simultaneously as being and becoming. It would seem possible to write goals and guidelines that combine the two views of children more often. From our perspective, it would seem that such an approach could support preschool teachers and working teams to actively use children's current norms and values, skills and knowledge in planning

activities that would both produce and reproduce cultural understandings, including those about mathematics. Such an approach is more likely to contribute to a socialization that acknowledges the uncertain futures that children will have as they head towards adulthood.

Although our study of the revised curriculum's goals and guidelines suggests that the ways that children are positioned may be in conflict in different sections of the curriculum, there is a need for research that investigates how teachers actually plan and implement activities based on the revised curriculum. Delacour's (2012) research indicates some of the different interpretations that teachers have when planning mathematical activities. Our research for this paper suggests that more research is needed to understand how teachers' actual practices may affect children's opportunities for socialization.

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Article III

Lembrér, D., & Meaney, T. (submitted). Towards an understanding of preschool activities: Bringing being and becoming into the mathematical activity.

The findings in Article II led me to this last journal article, where I re-analysed the data from the conference paper to emphasise how children's being and becoming mathematicians were constructed by joint participants (peers), facilitator (teacher) and objective observer (researcher).

Article III links learning, education and socialisation with children's peers and the teacher's role in these interactions. As I earlier described in Part 1 of this overview, "Socialisation, learning and education", processes of socialisation include one more component on top of recognising children's own interests, societal norms and values: that component is subject learning. And as I conclude in Article II, there is a common global concern that the knowledge and skills forces of schoolification obligate us to see preschools as preparing children for the demands of compulsory schooling.

Article III provides insights into the roles that all participants had in interaction and illustrates how mathematics activities can be operationalised in preschool. However, further investigation of each child's own strategies, as described in the section "Socialisation and children's being and becoming" by Ebrahim (2011), could bring broader understanding of how children, as active agents, individually produce knowledge as being mathematicians; also, that they gain new knowledge and skills by becoming a part of the reproduction of existing norms of educational practices within which goals and guidelines are operationalised.

III

TOWARDS AN UNDERSTANDING OF PRESCHOOL ACTIVITIES: BEING AND BECOMING IN A MATHEMATICAL ACTIVITY

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This article investigates a map-drawing activity in a Swedish preschool from the perspective of how three different agents contributed to children being positioned as being or becoming mathematicians. The agents are the children themselves, the teacher and the researcher. Each agent positioned the children in slightly different ways. The children position themselves as being mathematicians, expressing and using their own experiences and skills. The researcher also focused on the children's expertise and thus positioned them as being mathematicians while the teacher sometimes did. However, at times the children acknowledged their need for more skills and knowledge to solve a problem and thus positioned themselves as becoming mathematicians. Similarly, the teacher's questions at times also focussed on developing children's mathematics skills. The questions emphasized incompleteness.

These experiences affect the kind of socialisation children experience in preschool, as being and becoming mathematicians. By contrasting the teacher's role with those of the children and the researcher, it is possible to show how the teacher affects children's socialisation and learning through her type of questioning.

Keywords: being, becoming, learning, mathematics, socialisation

INTRODUCTION

In this article, we investigate how three agents position children differently as 'being' and 'becoming' mathematicians in a preschool activity around map-making. The agents were joint participant (peer), facilitator (teacher), and observer (researcher). Investigating the similarities and differences across the positioning of the three agents provided us with opportunities to explore children's socialisation and learning.

When young children's learning of mathematics is promoted as beneficial, it can emphasize what knowledge or skills children have not yet acquired but which adults deem necessary for them to know. Much of mathematics education research has focused on the mathematics that young children are capable of learning and the impact that this learning will have on their school achievement (see Clements & Sarama, 2007; MacDonald et al., 2012; Perry et al., 2008). For example, Duncan and colleagues did a meta-analysis of six longitudinal studies (Duncan et al., 2007). The authors suggested that if young children knew more mathematics when they began

school, they would have better chances of learning at school as well as learning other subjects such as reading. Thus, this research on young children's mathematics focused on what children needed for school, not what they could do already.

However, highlighting mathematics education as beneficial for young children is a change from perceptions in the first half of the twentieth century, which considered young children as too immature to engage in formal learning (Meaney, 2014). Views about what young children need to learn about mathematics are thus not static but reflect changes in society, social structure and expectations, and the society's future needs (Lee, 2001). These changes affect the norms and attitudes in children's different socialising worlds. Consequently, a lack of reflectivity about the role of mathematics education in young children's socialisation can be problematic when changes are made to some of these socialising worlds such as preschools.

Preschool as an institution is framed by and organised through the norms and values highlighted in the curriculum (James & Prout, 2001). For example, the Swedish curriculum (Skolverket, 2011) describes the necessary knowledge and skills that Swedish society, through the National Agency for Education (*Skolverket*), considers should be acquired. In planning activities based on the curriculum guidelines, preschools make children aware of those norms and values (Lee, 2001). As Bond (1981) wrote in regard to school education:

In western societies the formal organization of education in school systems meant that schools became the principal purveyors of social facts and, thus, as formal institutions they were linked with other institutions in determining the structure of society and the attitudes, values, and behavior of the public. (p. 235)

Recently the Swedish preschool curriculum (Skolverket, 2011) was revised from the original version published in 1998. The intention of this revision was to increase the focus on literacy, numeracy and other subjects, while retaining an insistence that children's own interests should be the starting point for activities (I. Jönsson, Sandell, & Tallberg-Broman, 2012). Changes of this kind are likely to have an impact on the socialisation that children receive, and so they call for investigation.

With the increased focus in the revised curriculum on developing learning skills, Doverborg and Pramling Samuelsson (2011) raised concerns about the value that institutionalisation gives mathematics and how this valuing may constrain teachers from being able to see aspects of mathematics outside the curriculum. Although the curriculum also indicates that children's own interests should be the basis for their learning, Doverborg and Pramling Samuelsson worried that teachers would only provide activities that promoted the learning of mathematical content. Similar concerns have been raised elsewhere about the impact of formal mathematics education on children in preschool (Lange et al., 2012).

Different expectations about what and how children should learn may cause tensions for preschool teachers in planning and implementing activities. In this article, we

consider how children's engagement in a mathematics activity around drawing a map was viewed by different participants and the tensions which were evident in these perceptions. Our research question is:

How do the different agents in the joint participant position children as being and becoming preschool mathematicians?

How is this positioning likely to affect children's socialisation and learning?

BEING AND BECOMING AS WAYS OF VIEWING SOCIALISATION

Before analysing the data, we need to describe socialisation, in particular the concepts of being and becoming which form the basis of our analysis. Socialisation is a dynamic process with a range of interconnected aspects operating simultaneously. On one hand, as we have suggested, it includes the reproduction of valued knowledge about children's and others' roles in society through society's key institutions, such as the family, culture and norms (Lee, 2001). A slightly different perspective is that of Corsaro (1992) who considered socialisation to be a collective process that occurs when children participate in the adult world, while also producing their own unique world with other children. Regardless of definition, socialization allows for the reproduction of culture from one generation to another and ensures that societies sustain themselves over time.

The importance given to mathematics for young children in studies such as those by Duncan et al. (2007) can be seen as an illustration of a socialisation process in which some knowledge, skills and practices, such as counting, is viewed as more value than other knowledge, skills and practices, such as playing with toys. When we highlight what knowledge children need to gain to become fully functioning members of society, we conceive children as individuals who are in need of socialisation. From this perspective, their present states are only of interest as a comparison with what they should become and institutions have an important role in merging and perusing possibilities for that socialisation.

This view of socialisation situates children as insufficient, and as becoming adults. Thus, childhood is conceptualized as a journey towards a clear and knowable destination of adulthood, with children's present lives and activities seen only in terms of how they contribute to a preparation for these futures (Lee, 2001). From this point of view, childhood is a stage and a structured process towards becoming complete (James et al., 1998). Thus, from a becoming perspective, socialisation is about children needing to gain the socially valued knowledge and skills to become adults who can function appropriately in society.

On the other hand, it is also acknowledged that socialisation can contribute to altering a culture and the society surrounding it, through changing the knowledge, values and norms valued in contexts, as well as between different historical versions of each context. From this view of socialisation, children are recognized as being

knowledgeable, active participants in the construction of their childhood and their experiences (James et al., 1998; (Ebrahim, 2011; Markström & Hallden, 2009). As James et al. (1998) state, “Childhood diversity considers the infinite variety of the social context in which children live, leading to a deconstruction of childhood’s conventional, singular and reductive form” (James et al., 1998, p. 34). Children’s interests and previous experiences are linked to these many different contexts. By documenting children’s creative contributions to a shared peer culture, Corsaro (1992) concluded that the socialisation process itself is transformed if children have the support to produce their own shared worlds, rather than simply being part of situations in which an unequal adult–child relationship dominates. From this perspective, Qvortrup (1994) suggested that children’s being is about stability, completeness, self-possession and self-control, capacity for independent thought and action, and thus being should be respected. Children are considered active agents who can influence the lives of others as well as themselves (James & Prout, 2001).

The concepts of being and becoming provide insights into how changes in a society reshape the social structure through institutions such as preschool. Nevertheless, children’s being and becoming should not be considered in opposition to each other. Uprichard (2008) critiqued becoming when the concept conceives of children as ‘incomplete’ and thus incompetent, with adults as ‘complete’ and ‘competent’. In reviewing previous research, she noted that the issue of context had been raised as important in regard to competence. In some situations, children can display higher levels of competence than adults and so the distinction between being and becoming as one about completeness and competence was not helpful. Instead, Uprichard (2008) stressed that children’s being and becoming are complementary.

Trondman (2013) also critiqued the distinction between being and becoming and described children’s present and future as an integrated whole, with children having an intrinsic value in themselves and their present experiences. Adults have a responsibility to work with them to provide an open future. From this perspective, childhood is a process of ‘growing up’ in which futures, rather than being a naturally unfolding process, depend on changing contexts. Therefore, both children and adults have a multiplicity of beings and becomings. From this perspective, it is possible to investigate how children are positioned by themselves and others in to having particular sets of possibilities of being and becoming.

Trondman (2009) considered that it is unreasonable to talk about childhood without looking at the environment that includes the multiple worlds in which children operate. Within each of these multiple worlds, structures and expectations contribute to the development of values and norms. For example, mathematics education research as a discipline with its body of knowledge affects preschool norms and attitudes and thus children’s possibilities for being and becoming mathematicians.

In previous research (Lembrér & Meaney, 2014:2), we found that the goals and guidelines in the Swedish preschool curriculum (Skolverket, 2011) constructed

children as active agents whose knowledge and skills should be valued while also needing to become mathematicians by learning certain predetermined knowledge. From this investigation, it was unclear whether in teachers' planning and implementing of activities, the need for children to become mathematicians would outweigh teachers' consideration of their already being mathematicians with relevant skills and experiences. We proposed that further research was needed to understand how children's opportunities for socialisation are affected by engaging in activities in preschool. This is what we investigate in this article.

SOCIALISATION AND LEARNING

Although to this point we have only discussed it obliquely, we consider there is a relationship between socialisation and learning. Socialisation into a community requires learning about and incorporating into pre-existing understandings of the world the culturally valued knowledge, values and skills of that community. Radford (2008) described learning as a joint process of objectification and subjectification. For him, learning involves the learning of something; in preschool activities, based on the Swedish curriculum, the intention would be for it to be the learning of culturally valuable knowledge or skills. Objectifying is an active process of sense making that takes place during the activity and through continuous revision of learners' interpretations of those activities. Nevertheless, in the learning process, children use their current knowledge and skills to reflect on the new knowledge and skills they are acquiring. Children gain insights into culturally valued mathematical knowledge as well as insights into themselves as they utilise that knowledge in an active and socially reflective manner.

Radford's view of learning emphasizes the need for culturally determined forms of reflection. This has similarities with Biesta's (2007) view of socialisation as the "insertion of 'newcomers' into existing cultural and socio-political settings" (p. 26). For Biesta, much of what is labelled as education in school should be called socialisation. He considered that education would be better considered as preparation for an uncertain future, in which freedom "needs to be realised again and again" (p. 32). Radford's (2008) view of the subjectification aspect of learning seems in alignment with Biesta's view of education, as learners' reflections on how new knowledge, values and skills affect who they are and thus allow for creativity in learning "within the possibilities and constraints offered by the dynamic and ever-changing cultural-normative sphere of knowledge ... This is why learning is both a process of knowing and a process of becoming" (Radford, 2008, p. 225). It would seem then that for Radford being and becoming mathematicians are complementary positions for children to have.

Preschool teachers play a significant role in the socialisation of the young children in their care (Fleer, 2010). For example, Coates and Coates (2006) stressed the value of the interactions between a preschool child and an adult or another child as being

useful for extending ideas or exchanging points of view. These conversations can inspire children in their creativity. With regard to mathematics, it has been suggested that preschool teachers need knowledge about early childhood learning and development as well as how to encourage and challenge young children's mathematical awareness (Pramling & Pramling Samuelsson, 2011). Teachers who do not have this knowledge cannot encourage and challenge young children's mathematical understandings.

Therefore, learning, education and socialisation are related, with learners, their peers and teachers having connected roles. This article analyses how three different agents the children themselves (peers), facilitator (teacher), and observer (researcher) contribute to children's socialisation through being and becoming mathematicians in regard to one activity about map-making. In the next section, we describe the method for this analysis.

METHOD

In order to consider the differences between the agents, we chose to analyse data from a conference paper that included extracts from the interactions of a group of young children engaged in drawing a map. This paper was written by the first author (Lembrér, (2013) and was about interactions in which she was the teacher. Thus, this analysis of the facilitator/teacher's and observer/researcher's contribution to the socialisation is a self-reflection.

Although some work has been done on teachers acting as researchers investigating their own teaching practice (see for example, K. Jönsson, 2007), approaches to how beginning researchers learn to reflect on their practice is much rarer. Dunn's (2012) reflection on her different roles while collecting data on girls' play in a drama club that she also ran is one of the few studies of this kind.

Self-reflection about how the different roles contributed to children's being and becoming mathematicians required careful consideration. For example, in a discussion about how best to interview beginning English teachers, Baker and Johnson (1998) stated that 'teaching practice may provoke interviewees into taking up morally responsible positions for their practice' (p. 233). In a re-examination of Dorota's teaching practices, we needed to recognize that re-analysing how she had acted as a teacher, a role she had for many years, could result in her accounting for the moral responsibility of taking care of young children. Thus it seemed valuable for Tamsin, to take on the role of dialogue partner and co-author,. Our joint discussions about Dorota's work as a teacher and a researcher can be seen as mirroring Baker and Johnson's (1998) suggestion for what can be achieved through researcher-teacher interviews:

The purpose of the talk was to critique and perhaps re-theorise practice rather than defend it, that is, to move the teacher's practice and theory forward. It was prospective talk as well as retrospective talk ... it was more than reflecting, and more than accounting. The

post-lesson conversations involving the researcher and the teachers were another form of practising their respective professional knowledge. Talking about teaching was action in pedagogical space: a place for reformulation, renewal and recasting subject English as it could be enacted. (p. 233)

Collaborative analysis of this kind is not well documented in the research literature. Dunn (2012) used a colleague as a conversation partner in her analyses of play situations in which she had sometimes acted as a co-player. Our discussions about Dorota's reflections on her role were audiotaped and allowed for a more nuanced understanding about how children were positioned as being and becoming mathematicians than was possible in the conference paper (Lembrér, 2013). As well, in order to provide the necessary distance for the reflection and accounting of practice that an analysis of children's interactions required, we chose not to mention Dorota by name in the results section of this article. Rather, we use Dorota's two roles, teacher and researcher, as labels.

Analysing the positioning done by different agents

Our earlier research suggested that it was important to see how the tensions identified in curriculum affected children's being and becoming mathematicians in preschool activities (Lembrér & Meaney, 2014:2). However, such an investigation would have meant following a large number of teachers involved in multiple interactions in order to be able to say anything significant about how the curriculum tensions played out. Logistically this would have been difficult, so instead we decided to consider how the children themselves, their peers, their teacher and a researcher positioned them as being and becoming mathematicians in one interaction. This approach enables us to make an in-depth exploration on how different agents affected the positioning of children as being capable mathematicians with valuable experiences and skills, or becoming mathematicians by focusing on knowledge needed for school.

The analysis of the conference paper was done in a similar way to that performed in the curriculum research by identifying instances where definitions of being and becoming mathematicians were evident (Lembrér & Meaney, 2014). Our definitions of being and becoming mathematicians followed those of James et al. (1998), Lee (2001) and Qvortrup (1994). Children were judged as being mathematicians when their existing mathematical skills and knowledge seemed to be valued and they were positioned as capable of independent thought and action. On the other hand, when the skills and knowledge (e.g. concepts of measurement) that children would need for their future were the focus and children's incompleteness, dependency, changeableness in the present time and their journey towards adulthood highlighted, then the children were deemed as becoming mathematicians. The six transcript extracts discussed in the conference paper were re-examined to identify, first, whether and how the children positioned themselves and each other as being and

becoming mathematicians; then the teacher's and finally the researcher's positioning of the children were examined.

The interaction between the children and the teacher was discussed in the conference paper as an example of the measurement knowledge and skills. The five children, aged between two and six years had chosen to draw a map. The exchange took place in a Swedish preschool, in an age-integrated preschool group. Age-integrated groups comprise children who are between one and five years old, and this particular group had children aged one, two, three, four and five years of age. The results section of the original paper mentioned only four children: Child 2 was not represented in the interactions, as his only action was to hand toy vehicles to Child 4. The analysis in the conference paper focused on what the children could do in naturally occurring circumstances, rather than the knowledge and skills that were lacking.

The exchanges were originally in Swedish and have been translated into English. It is not always easy to translate young children's Swedish as their language is developing; consequently, it has been clarified in places to make it more understandable. This has changed the form but not the content of the children's language.

The activity began spontaneously before breakfast as children's play, with the children (one boy in particular) suggesting they should draw a map. Beginning as an observer, the teacher, Dorota, became an active participant in the activity by following the children's experiences and interests. Nonetheless, her questions and the children's answers indicated that she had an impact on the activity (Hasselgren & Beach, 1997).

The conflict between the teacher's collection of the data in her field notes and being a co-player with the children was resolved by a teaching colleague taking over the writing of the field notes. This allowed for more material to be collected, including written descriptions of dialogues, than if Dorota had tried to continue in both roles.

POSITIONING OF CHILDREN BY THEIR PEERS, THE TEACHER AND THE RESEARCHER

Being mathematicians

In the conference paper, four examples illustrating the positioning of children as being mathematicians were identified. The children themselves, the teacher and the researcher positioned children in this way in the interaction around drawing a harbour, a railway, a road and an airport runway.

The skills and knowledge to take action or make decisions were used by the children during the interactions and were recognised by the teacher in the kind of questions she asked. For example, the questions were open-ended and were followed by children showing their capabilities. As all four examples showed similar ways that their peers, the teacher and the researcher positioned the children as being

mathematicians, only one is described here, the interaction when Child 4 drew a harbour.

Following is the part of the conference paper which presented the interaction and analysis of dialogue as Child 4 was drawing a harbour (Lembrér, 2013):

The following exchange illustrates how Child 4, the girl who drew the railway, began to draw a harbour. The harbour was needed because, as the children discussed, it was possible to travel by boat. Child 4 took a pen and drew a line in front of a boat, then she put another boat behind the first and repeated this until she had five boats, lined up one behind the other, like cars parking on a street, and drew two lines:

Child 4: I'm drawing a harbour, I place my boats behind each other and I have five boats. I have to draw all five to get space.

Dorota: Do you make space for your boats?

Child 4: Yes, I know how large a harbour should be now.

Dorota: How do you know?

Child 4: My first boat is behind this line (she points). I have drawn two lines now, you see (she takes away the boats and points to the two lines).

Dorota: Okay, a line in front of the first boat, and a line behind the fifth boat.

Child 4 used the boats, as physical objects, to find out and measure the area needed for the harbour. To do this, she built on the attribute idea of comparison by using length as a default for area measurement. The iteration was of five boat lengths, which formed the area of the harbour when boats were placed one after the other. Similarly to when she was drawing the railway line, the child used five identical units and filled a space without gaps, suggesting the unit concept of tiling. By drawing a line at the end of the last unit, she identified the endpoint for her measurement, which is a component of the concept of scale. As the teacher, I took the opportunity to use ordinal terms, 'a line in front of the first boat, and a line behind the fifth boat', to highlight these endpoints. (p. 2154-2155)

In the re-analysis, Child 4 positioned herself as being a mathematician by showing and describing how she determined the appropriate area for the harbour - "My first boat is behind this line (she points). I have drawn two lines now, you see (she takes away the boats and points to the two lines)". In this way, she showed that she was in control of determining the appropriate area for the harbour by using her existing knowledge and skills to mark out the space needed by each boat.

The teacher asked two questions: Do you make space for your boats? and How do you know? These are open-ended questions because the teacher could not predict the answers. This indicates that the teacher considered the child to be in control of the interaction. Accordingly, we suggest that the child is positioned by the teacher as having the capability to make her own choices in relationship to taking action rather than needing help to solve the problem of measuring the space needed for the harbour.

The researcher noted that Child 4 was using length as a default for measuring area. However, rather than focusing on what the child could not do, use square units to measure area, the researcher positioned the child as being a mathematician by noting that she used five identical units side by side without gaps, suggesting that she understood the measurement concept of unit tiling. The researcher drew on previous research by Bush (2009) to determine what this child knew. From this judgement, Child 4 was situated as capable of using existing skills to solve the problem of how to draw the harbour.

Becoming a mathematician

The positioning of children as becoming mathematicians appeared in only one of the 6 extracts discussed in the conference paper. The child is positioned by the teacher, the researcher and the child himself. The teacher's questions are different in this extract and focused on contextual aspects of the map drawing and concepts of measurement that the children use in the interactions. The following comes from the conference paper (Lembrér, 2013):

The next example shows Child 5's explorations of width, putting two vehicles side by side and using his experience and knowledge about traffic and directions. Child 5 starts by drawing a road which he links to the train station.

Child 5: How much space do I need? I want to have a two-lane street, so my car can drive in both directions.

Dorota: What do you think? How much space does your car need, how wide is the car?

Child 5 looked at the car and drew a straight line beside it. He moved the car sideways and drew another line. The street was compared to how wide the car was. Child 5 used two identical units, the cars, and put them side by side on the road to see if they fitted into the space. By doing so, he subdivided the width of the road in order that the cars could drive in both directions. The cars were placed side by side with no gaps between, indicating tiling. He estimated the width of the road by placing the cars together in a similar manner to what Child 4 had done with the trains. (p. 2152–2153).

Child 5 was unsure about his knowledge and capability so he asked the question: How much space do I need? By showing his lack of certainty, he positioned himself as becoming a mathematician. The teacher responds to Child 5 by asking him to focus on one aspect of a car, its width, and guided the child to solving the problem himself. Although the teacher acknowledges with her question that the child could not solve the problem himself and therefore was lacking in skills, her question suggests that the child would understand how to use the width of the car to solve the problem. Thus, she positioned him as becoming a mathematician by asking a question that she herself knew the answer to, but also as being a mathematician because she seemed to anticipate the child had the appropriate knowledge to respond to her question. Similarly the child's action after this question showed that he could use his own knowledge and so positioned himself as being a mathematician.

The teacher's questions were different to those in the examples where the teacher only positioned the children as being mathematician(s). In this case the teacher knows the answer to her own question and, as it turns out, so does Child 5. It is possible to hypothesise that if the child had not been able to respond appropriately to the teacher's question, the teacher would have posed another question with the hope that the child would be able to successfully respond to it.

The researcher in the conference paper (Lembrér, 2013) was interested in the Child 5's actions following the teacher's question and so concentrated on what he could do. The researcher did not mention anything about the child's exhibition of dependency or lack of knowledge about how to determine the width of the road. Consequently, the researcher positioned the child as being capable of action based on what the child already knew and could do. From the researcher's perspective, Child 5 is being a mathematician rather than becoming one.

Being and becoming mathematicians

Three of the interactions from the conference paper suggested that children were positioned as being *and* becoming mathematicians simultaneously. These were to do with drawing a runway, a road and a bridge. In the case of drawing the road, which was described in the previous section, Child5 started by being positioned as becoming a mathematician by both himself and the teacher. However, as the interaction developed, the child and the teacher reset the parameters of the interaction so that the child came to be positioned as being a mathematician. This change in perspective seemed to facilitate children's learning within a playful activity, where the power relationships between the child and a teacher are different to those in a formal teaching situation. In playful activities, children have better possibilities for engaging or withdrawing from a situation so a teacher must pay attention to the children's own interests (Lange et al., 2014).

A further example of children being positioned as both being and becoming mathematicians is provided below and is about how the teacher worked with the children to make a bridge to be placed on the map. In the re-analysis of the conference paper, the importance of the teacher's questions and children's responses to these questions in positioning the children as becoming and later being mathematicians. The questions seemed to help children see possibilities for solving a problem without giving them the answer directly. This positioned them as becoming mathematicians who could not solve the problem without help, but at the same time being mathematicians, who would use their own experiences and knowledge in order to gain new mathematical knowledge or problem-solving strategies.

Sometimes physical objects were not sufficient for developing some ideas and it was I, as the teacher, who provided the stimulus. When it was time to draw a bridge, I challenged them to think more about height and width. To begin with, I took a piece of paper and

said, 'How long should the bridge be?' A girl replied, 'As long as a car'. Then I cut a piece of paper, so that it was as long as the car the girl gave me.

Dorota: Is it a bridge? (The teacher looked at Child 4, who put the piece of paper on the map.) Is it a bridge?

Child 4: No, how should we make one? What should we do?

Dorota: (took a larger piece of paper, gave it to Child 5.) Can you cut out a strip, which has the same width as this piece (the piece Child 4 cut, which was too short)? It's as wide as two cars. This has sufficient width to be a road in two directions.

Child 4: We take two cars put them on the piece of paper, one after the other. Is that enough?

Dorota: How do we know that the bridge has enough width and height to allow a train to drive under it?

Child 5: A train must be able to drive under the bridge, we try (The teacher takes a train, holds up the piece of paper and pushes it upwards until there is space enough to drive the train under it.)

Child 4, together with Child 5, wanted to build a bridge for cars to drive over and trains to go under. The width of the paper was compared to the width of two cars. Child 4 said, 'We take two cars, put them on the piece of paper, side by side, and cut'. In placing two cars side by side, they showed the concept of iteration. The cars were identical units, and these units filled the space without gaps, thus tiling was used. Relativity in measurement took place when they needed to cut a piece to fit two kinds of units, cars and trains. The piece of paper, the cars and trains were compared directly. (Lembrér, 2013. p. 2154-2155)

As noted in the beginning of this extract from the conference paper, the teacher posed a question about building a bridge. In doing so, the teacher positioned the children as being mathematicians capable of solving the problem. Although the teacher knew the answer to the question, it seemed that the teacher also expected the children to be to provide an answer with the knowledge and skills that they had. This was borne out when a child responded immediately. Her suggestion 'as long as a car' is also an example of being a mathematician.

At this point, the teacher could have indicated to the child that this suggestion was incorrect and directly positioned the child as becoming a mathematician. Instead the teacher followed up on the child's suggestion and then had the child evaluate whether the solution was appropriate or not. The child used the evaluation to then ask for help and in this way positioned herself as becoming a mathematician, needing support from others in order to make a suitable bridge. As the interaction progresses, the children alternated between being knowledgeable about the problem and so being a mathematician, and showing a lack of knowledge and thus becoming a mathematician. This can be seen in the example from when Child 5 says, "A train must be able to drive under the bridge" which shows appropriate knowledge for

solving the problem, but also uncertainty when he finishes with, “we try”. By making this statement, he positions himself as both being and becoming a mathematician.

By posing the first question, “how long should the bridge be?” the teacher set a clear direction for the conversation. In knowing the answers to most of her questions, she positioned the children as becoming mathematicians who need guidance to find the “correct” answers. By asking such questions, she seemed to assume that the children were not capable of independently making the bridge, a complex task which required the children to recognise that the bridge needed to be both wide enough to fit two cars driving in opposite directions and high enough for a train to pass underneath. On the other hand, by making suggestions about what they should do, the teacher positioned the children as having the necessary skills to work on the bridge. In part, this may indicate that the teacher is pushing them to realise that they have the knowledge even though they are not entirely sure how to use it to solve this problem.

This example shows some of the complexity and different ways that children are positioned as becoming mathematicians, while using their own experience and skills during the activity. This was also the case in regard to the researcher’s perspective. The focus of the researcher’s comments in the conference paper was on what the children could do in regard to determining the appropriate width of the bridge by placing two cars side by side on the paper and thus making a direct comparison between the height of the bridge and the height of the train. This positioned them as being mathematicians who used their own ideas to solve the task. At the same time, the researcher seemed to suggest that Child 4 and Child 5 were learning about the measurement concept of relativity although this is not stated explicitly.

DISCUSSION

In the analysis, our purpose was to understand whether and how different agents affected children’s opportunity to position themselves or to be positioned by others as being or becoming mathematicians. In other words, we investigated the operationalisation of the socialisation process. As suggested in our earlier research (Lembrér & Meaney, (2014), the general goals for the Swedish preschool curriculum link children’s being as individuals with their journey towards becoming socialised members of their society. We had been interested in how the potential tensions between children’s being and becoming might play out when activities were implemented in the preschool. The analysis of this example suggests that as a child-initiated activity, in which the teacher spontaneously responded to what the children were doing, strongly affected the structures surrounding the ways of interacting and this then affected the norms and values that came into play. As Björklund (2010) suggested children encounter many phenomena in the world which they try to understand. Through interactions around these phenomena, children have opportunities to explore their own and others’ ways of understanding the phenomena. The context of map making was one child’s idea but it was readily

accepted by the other children who eagerly contributed, drawing different components on the map. This context allowed for different kinds of interactions, generally around solving different problems to do with the map drawing. Although originally conceived as an example of the kinds of measurement concepts that children displayed in contexts that were of interest to them, the re-analysis of the conference paper suggests that the children and teacher made spaces for the children to learn, which built upon what the children could already do. This enabled us to see how socialisation and learning were linked.

The analysis of the conference paper indicates how children affect their own socialisation through their actions while doing particular tasks or problems. Although children's interests and experiences have been acknowledged previously as being important (Coates & Coates, 2006; Johansson, 2011; Karlsson, 2011), the concepts of being and becoming mathematicians provided insights into the role they played in interactions. The task seemed to offer opportunities for the children to position themselves as being mathematicians who had appropriate knowledge and skills. It also provided possibilities for them to identify the knowledge and skills they were lacking in order to solve problems which allowed them to be positioned as becoming mathematicians.

Of all the participants in the interactions, the children were the ones who were most likely to position themselves as being mathematicians. Although they would not have labelled the knowledge and skills that they are using as mathematical, they often exhibited appropriate knowledge and skills of measurement to solve the problems that they set for themselves in drawing a map. Fleer (2010) suggested that younger children in preschool probably are unaware of the value of their own experiences and the teacher has to encourage this awareness. On the whole, this was not the case in this interaction, perhaps because of the way that their contributions were received by the teacher. However, in some instances, watching another child solving a similar problem allowed the children to utilise knowledge and skills that they had not immediately recognized as being relevant for the problem, as was the case with Child 5 drawing the roadway.

At other times, such as when they wanted to make a bridge, they sought more explicit instructions about what they should do. The task also enabled them to make decisions about the skills and knowledge that they did not have. Coates and Coates (2006) suggested that children's ideas can be extended further through interactions with others and this certainly seemed to be the case in this interaction. Although these examples suggest that the children were becoming mathematicians, their demeanour in how they sought and found help suggested that they were comfortable and confident in their role of becoming mathematicians. Radford (2008) suggested that learning involves objectification of new knowledge as well as subjectification, becoming someone. If it is accepted that being a mathematician involves recognising and being comfortable with knowing that one's skills and knowledge may not be

sufficient, then becoming a mathematician must be seen as a natural extension of being a mathematician. The children seemed to be learning the knowledge, values and norms of the society that they lived in, in this example these were specific measurement understandings. The manner in which they did this, through problems that were of interest to themselves, seemed to provide possibilities for them to produce, not just reproduce, knowledge, norms and values needed for dealing with new problems in their uncertain futures.

In the interactions, other participants, such as the teacher and the children's peers, followed the child's lead in positioning them as being or becoming mathematicians. For example, when the children displayed their capabilities and positioned themselves as being mathematicians, the questions the teacher asked were ones she did not know the answer to, such as when Child 4 made a harbour. However, when Child 4 indicated that she was not confident or capable, as in the example of the bridge building, the teacher already knew the answers to her own questions. The purpose of the questions was not to find out new information about what the children were doing but to guide the children into successfully solving the problem that they were engaged in. The teacher's role was thus adapted to that of the child with whom she was interacting. Highlighting how the teacher contributes to positioning the children as being or becoming mathematicians shows how the children's control of the choice of activity influences the sorts of questions that can be asked when children are knowledgeable and when they request support.

The teacher also appeared confident and capable in the interactions, suggesting that she positioned herself as being a teacher. However, it is clear that the children surprised her at different times, such as when the first child decided that the activity should be making a map. By allowing the children to have control of the activity, she did not relinquish being a teacher but did show that she had things to learn from the children and so also positioned herself as becoming a teacher, with incomplete knowledge of what children could do. This is not a critique of her as a teacher but rather it shows that understandings about becoming are relevant for adults as well as children.

The researcher's positioning of children as being or becoming mathematicians is different from that of the teacher. It seems that the phrasing of the research question resulted in a focus on children being rather than becoming mathematicians. However, given that the positioning by the children, and to a lesser extent the teacher, provided opportunities for the interaction between the being and becoming to be seen simultaneously, it seems that a research question that focused on just one aspect contributed to important information in the interaction being missed.

As well, focusing on measurement concepts as the valuable knowledge that children needed to learn for their futures suggested that the researcher was not so much interested in the production of new knowledge as a reproduction of existing knowledge. Although their problem solving skills were noted, the possibilities that

these might lead to the production of new knowledge for children's uncertain futures, as discussed by Biesta (2007), was not part of the awareness of the researcher.

Like the children drawing the map, the researcher used her skills and knowledge to solve the problem identified in the research question. Although the researcher does not openly admit, as the children did, what she does not know or can do, her language in describing the children's interactions, such as in the discussion of the first extract suggests that her analysis did not always clearly show her what the children could or could not do in regard to measurement. Thus, she simultaneously positioned herself as both being and becoming a mathematics education researcher.

CONCLUSIONS

In this paper, we have investigated the socialisation of a group of children interacting in a Swedish preschool by exploring how they were positioned as being and becoming mathematicians by each other, by the teacher and by the researcher. Socialisation is important for it considers how children are integrated into a society through learning the necessary and valued knowledge to become fully functioning adults and to reproduce the knowledge that society sees as important to pass on to future generations. At the same time, rather than specifying any predefined knowledge, skills and abilities that children should require to achieve success in everyday life, the central focus of being is to accept children as active citizens, who can influence their own lives. These activities unfold against the background of how institutions engage in pedagogical practices that recognize and build on the multiple worlds in which children live.

As noted in the previous section, reflexive research such as used in this analysis can provide feedback about the many levels at which socialisation occurs. To achieve this, reflexive research also requires an ability to stand away from the positions that adults have in children's lives to consider what other alternatives might be possible. This is not easy to do, especially as a beginning researcher so possibilities such as having a conversational partner are important and need to be discussed more often in research of this kind.

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6. DISCUSSION AND CONCLUSIONS

This discussion and conclusions section is divided into six sub-sections. The first sub-section begins with a reprise of the research questions and aims for each of the articles. This is to clarify how the research questions of each article correspond to the overall research questions of this study. In the second sub-section, I address the first question of the overall study: What is the influences of mathematics education on the socialisation in the Swedish preschool? The third sub-section proposes answers to the second question: How are the concepts of being and becoming mathematicians operationalised in a Swedish preschool? This is followed by a discussion on the relationship between implementation and operationalisation. I conclude by defining the direction of my future research and offer some “final words”.

Towards an understanding of how the Swedish preschool constructs mathematics

The aim of this study has been to explore a broader understanding of mathematics education in the Swedish preschool through considering children’s socialisation. There are many studies on young children’s learning in mathematics; however, there is a lack of studies that illustrate how the goals and guidelines of the revised curriculum affect children’s opportunities and the kinds of socialisation that appear in the Swedish preschool. In discussing the provision of activities for children in Article I, my aim was to investigate how children’s own experiences can promote mathematical learning when they are engaged in activities (Lembrér, 2013). The conceptualisation of early childhood education in Article II allowed me the posing and answering of

questions about the process of socialisation by investigating the preschool curriculum (Lembrér & Meaney, 2014). The question of the operationalisation of the curriculum is raised in Article II. The interactions in Article I were re-analysed in Article III in order to answer the question about how different roles position children as being and becoming mathematicians (Lembrér & Meaney, Submitted).

Each of my articles is intended to contribute to the field of early childhood education and the subject learning of mathematics. The following research questions and aims are discussed, analysed and answered in the included articles:

Article I: How do children use measurement concepts in an interaction that draws on their outside preschool experiences? Aim: to understand how children's outside experiences can promote mathematical learning.

Article II: Does the increased influence of schoolification on the curriculum produce tensions that are likely to affect preschool teachers' perceptions of the activities that they should provide to children? Aim: to investigate the goals and guidelines in the revised preschool curriculum and consider how an increased emphasis in those related to mathematics may affect the kind of socialisation children could acquire.

Article III: How do the different agents in the joint participant position children as being and becoming preschool mathematicians?

How is this positioning likely to affect children's socialisation and learning? Aim: to investigate how children's engagement in a mathematics activity was viewed by different participants.

What is the influences of mathematics education on the socialisation in Swedish preschools?

I have used socialisation as a notion that has provided an interpretive frame for understanding mathematics education in Swedish preschools. The preschool can be thought of as a setting where children are socialised as active agents, knowledgeable, skilled persons, at the same time becoming organised by institutional norms and values with a forward-looking approach to subject learning and schooling.

In the research on mathematics education, there is a perception of the need for young children to have a stronger mathematical understanding when they begin school. The recognition that it is an important part of preschool education suggests that the focus of

the curriculum has strengthened the emphasis on what society values as beneficial. The unique results of analysing the goals and guidelines in the revised preschool curriculum have shown the kind of socialisation that preschools provide for children. Therefore, in this study, the term “operationalisation” is used to discuss the provisions of activities for children. These provisions are expressed within the curriculum goals and guidelines. Nevertheless, there is a lack of early childhood studies that observe mathematical activities based on children’s ideas and/or not yet developed mathematical representations. These are often seen slightly differently in the eyes of children and adults (e.g. Carruthers, 2006).

This study contributes to the field of mathematics education by relating three components: production (knowledge and skills), reproduction (norms and values production) and the global issue of schoolification. The results provide a broader understanding of the influences of mathematics education on the Swedish preschool. In Article I, the focus is only on children’s mathematical representations of the concepts of measurement; Article II examines the impact of goals and guidelines on children’s possibilities for socialisation; and Article III investigates positioning in regards to what is valued by different participants in the interactions.

The impact of mathematics is dependent on the interpretation of the goals and guidelines of the curriculum and hence on how children are seen by teachers and working teams in preschools.

How are the concepts of being and becoming mathematicians operationalised in a Swedish preschool?

The concepts of being and becoming could provide new insights about changes in our society. The concepts reflect the norms and values underlying the revised preschool curriculum. These norms and values influence or limit choices or opportunities available in preschool as they act as institutional regulators of both the pattern of interaction among children and the social relationships within society (James et al., 1998). The concepts of being and becoming link children’s preschool socialisation with institutional practices and mathematical activities. These concepts allowed me to elaborate on my understanding of the complexity of subject learning, which often seems to be taken for granted.

What is unique about using these concepts is the contribution to the knowledge of how the complementary view of childhood can be identified. It is primarily about how to engage in pedagogical

practices where children's own experience, interests and views can be expressed, while institutional practices tend to emphasise forward-looking mathematical goals. As earlier discussed, this tendency is connected with the notion of schoolification.

In Article II, it was found that children's becoming is supported by the curriculum goals for developing their mathematics skills, and that the concept of children as being mathematicians is supported by recommendations that their experience and knowledge should be used in activities.

In preschool, the positioning of children as being and/or becoming mathematicians is dependent on how adults operationalise the goals and guidelines of the curriculum in activities. In Article III, it can be seen that children not only take on different positions, but also negotiate those positions simultaneously as they participate in the activity.

To conclude, the societal views and perceptions of children and childhood influence what is stated in the curriculum. This in turn influences how activities are implemented and children then are socialised.

The relationship between implementation and operationalisation

I mentioned in the introduction that this study was written within the framework of the Malmö University graduate school for preschool teachers (FobaSM), with an overall focus on childhood, learning and didactics. My aim has been to gain a broader understanding of mathematics education in Swedish preschool through considering children's socialisation. Consequently, I have explored how the processes of socialisation are central for (subject) didactics in preschool.

This study has contributed to knowledge about the teaching of mathematics in Swedish preschools and reasoning about childhood by considering how the environment supports the production and reproduction components of socialisation. Therefore, the chosen concepts of being and becoming are significant for the purpose of investigating the various components of socialisation in the institution of the Swedish preschool. The study does not claim that the situation of all children being and becoming in mathematics activities is constant. While that may be the case, the results contribute to a discussion of the meaning of early childhood studies by challenging assumptions that children's interest and experiences are operationalised as starting points for all activities through goals and guidelines in the revised curriculum. It is not

then possible to claim that mathematics education does not have a global driving impact on early childhood education in Sweden.

What young children are capable of doing mathematically is limited by the opportunities provided for them to engage in activities. The relationship between implementation and operationalisation is of great importance. The results of this study indicate that preschools are necessary institutions for strengthening children's constitution of social competence and a general ability to handle their childhood as they live in a modern world with expectations of their ability to be both independent and a part of a democratic society at the same time. However, all persons working in preschools should consider children as social agents, with their own rights, opinions and interests, rather than simply as parts of a forward-looking plan.

Future directions for research

In my research, I identified tensions in the curriculum in regards to how socialisation and children's being and becoming mathematicians give insights into the role of mathematical activities in preschools in children's socialisation. However, this should be further investigated, primarily in order to problematise the increase in schoolification in the revised preschool curriculum. There is a need to examine if this schoolification affects how preschool teachers implement the mathematics activities. The operationalisation of goals and guidelines and "the needs and interests which children themselves express in different ways" (Skolverket, 2011a, p.12), should be explored further., An additional argument for investigation is the role that the preschool might have in contributing to children's socialisation, with mathematics education as a part of this. In this endeavour, it is also highly relevant to consider the tension between schoolification and traditional foundations of preschools as institutional practice in Sweden.

Final words

All conclusions in this study are based on the results presented in articles and related to literature. While I acknowledge that all research should be reported in a clear and accessible way, English is not my first language; as a matter of fact, it is actually the third. My first language is Polish, and a reasonable command of Swedish is the second. Having access to many languages can be seen as an advantage insofar that it is possible to elaborate on different

meanings in words. At the same time, it can be a challenge to write and express ideas in a third language. Thus, the writing process has for me been like a journey amongst different languages and ways of expressing ideas. I have tried to express my thoughts clearly in the English language, and it has been interesting for me to trace my own development as a licentiate student and realise that education has given me new insights and knowledge that I have been able to use in the academic writing process.

The articles included with this thesis were written over a period of time when my writing competence was developing. My academic and linguistic journeys have been parallel but always different. This gave me new insights into childhood studies and mathematics education. This development never followed any specific pattern. Hence, socialisation, learning and education have come for me to be situated together somewhere on the spectrum between being and becoming.

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