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Sociocultural influences on parents' views about mathematics education for young children

Dorota Lembrér

Thesis for the degree of Philosophiae Doctor (PhD)
at the Western Norway University of Applied Sciences

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Scientific environments

This thesis has been written as a part of studies in the PhD programme Bildung and Pedagogical Practices at Western Norway University of Applied Sciences (HVL), Bergen.

The scientific environment that I am involved in is KINDknow–Kindergarten Knowledge Centre for Systemic Research on Diversity and Sustainable Futures. The centre is located at HVL in Bergen, where Elin Eriksen Ødegaard is the leader. KINDknow is a collaboration with researchers from HVL, the Arctic University of Norway (UiT) and the University of Stavanger. Within the centre there are ten research groups, and I am involved in a group that focuses on multilingual mathematics. Tamsin Meaney is head of the group.

This project is associated with the mathematics of young children research group led by Troels Lange at HVL. In this research group, the research focuses on how wider societal changes, such as changes in the demographics of children attending ECEC, may affect children's opportunities to participate in mathematical activity. The researchers are also interested in how young children aged one to five engage in mathematical activity through play in the home and early childhood institutions.

The scientific environment introduced by supervisors has also included participation in educational conferences, as well as courses and lectures (e.g. CERME, EECERA, NAFOL and YESS9). In addition, I joined a seminar series from the LATACME (Learning About Teaching Argumentation for Critical Mathematics Education in Multilingual Classrooms) research group at HVL.

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Thank you all,

Dorota Lembrér, Hjärup, Juni 2021

Abstract

This thesis investigates parents' views on mathematics education for young children at home and in Early Childhood Education and Care (ECEC) institutions in Sweden and Norway. The curricula documents for ECEC highlight the importance of collaboration between teachers and parents for children's learning and development. However, the views of parents on the education of young children are seldom explored in research. The assumption that parents and other family members can contribute to children's mathematics education is a fundamental assumption in the current project.

The narratives of parents of their experiences with young children in mathematics education were analysed to identify answers to the following overarching research questions. how can parents' views on mathematics activities for young children be identified? what do parents' value in mathematics education for young children? and what might influence parents' views on mathematics education? Parents' views were investigated by collecting data from online surveys of Polish parents living in Sweden and through photo-elicitation focus group interviews with Norwegian parents.

The narratives that were produced from these two data collections provided different insights into parents' views on mathematics education for young children which have to do with the relationship between parents' individual views and wider societal views. The findings indicate that counting was viewed as important for young children, and everyday life experiences were considered an appropriate means of introducing them to mathematical ideas. Many of the parents emphasised their role in children's mathematics learning and its impact on how the children engaged with mathematics at home. The findings also indicate that parents' views on mathematics education are influenced by wider societal expectations connected to ECEC pedagogical practices in mathematics education.

The implications of this research include an understanding of the kinds of opportunities there are for parents to contribute to the introduction of mathematics education to ECEC. Nevertheless, the research results also show that collaboration

between parents and teachers can be challenging because of the different nature of their roles. Consequently, one outcome of this research is the identification of a need for further research into the complexity of collaboration as this relates to the negotiation of different understandings of pedagogy, mathematics and roles and responsibilities in children's learning of mathematics.

Sammendrag

Denne avhandlingen undersøker foreldres syn på matematikkundervisning for små barn hjemme og i førskoleinstitusjoner i Sverige og Norge. Læreplandokumentene for barnehagen understreker viktigheten av samarbeid mellom lærere og foreldre for barnas læring og utvikling. Likevel blir det sjelden forsket på foreldrenes syn på små barns utdanning. Det er en grunnleggende forutsetning for prosjektet at foreldre og andre familiemedlemmer kan bidra til barnas matematikkundervisning.

Foreldrenes fremstilling av sine erfaringer med matematikkundervisning for små barn ble analysert for å gi svar på de overordnede forskningsspørsmålene: Hvordan kan man finne foreldrenes syn på matematikkaktiviteter for små barn, hva og hvordan verdsetter foreldrene ved matematikkundervisning for små barn? Foreldrenes syn ble undersøkt ved å innhente data fra spørreundersøkelser på Internett blant polske foreldre bosatt i Sverige samt fra fokusgruppeintervjuer med norske foreldre.

Svarene som fremkom av to datainnsamlinger, gav ulike innblikk i foreldrenes syn på matematikkundervisning for små barn når det gjelder forholdet mellom foreldrenes individuelle syn og bredere samfunnssyn. Funnene indikerer at telling ble ansett som viktig for små barn, og hverdagsopplevelser ble ansett som en passende måte å presentere dem for matematiske ideer på. Mange foreldre understreket sin rolle i barnas matematikklæring og hvordan dette påvirket måten barna forholdt seg til matematikk på hjemme. Funnene viser også at foreldrenes syn på matematikkundervisning påvirkes av større forventninger i samfunnet forbundet med pedagogisk praksis for matematikkundervisning i barnehage.

Resultatene av denne forskningen omfatter en forståelse av mulighetene for å innføre matematikkundervisning i førskolen som foreldrene kan bidra til. Ikke desto mindre viste forskningsresultatene også at et samarbeid mellom foreldre og lærere kan være utfordrende på grunn av de ulike rollene de har. Følgelig er et resultat av denne forskningen at det er behov for videre forskning på kompleksiteten i samarbeidet mellom foreldre og barnehagelærere når det gjelder å formidle ulik

forståelse av pedagogikk, matematikk samt roller og ansvar for barns matematikklæring.

List of publications

This thesis is based on the original articles listed below. In this thesis, the articles will be referred to by their Roman numerals.

I. Lembrér, D. (2018). Polish parents' views on mathematics activities at home and in Swedish preschools. *Nordic Studies in Mathematics Education*, *23*(3–4), 185–201. http://ncm.gu.se/wp-content/uploads/2020/06/23_34_185202_lembrer-1.pdf

II. Lembrér, D. (2019). Using photo-elicitation in early years mathematics research. In U. T. Jankvist, Van den Heuvel-Panhuizen, M., & Veldhuis, M. (Eds.), *Proceedings of the Eleventh Congress of the European Society for Research in Mathematics Education* (CERME11, February 6–10, 2019). (pp. 1912–1919). Utrecht, Netherlands: Freudenthal Group & Freudenthal Institute, Utrecht University and ERME. https://hal.archives-ouvertes.fr/hal-02421373

III. Lembrér, D. (2020). Parents' valuing of mathematics for young children. In M. Carlsen, I. Erfjord, & P. S. Hundeland (Eds.), *Mathematics Education in the Early Years: Results from the POEM4 Conference, 2018* (pp. 403–420). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-34776-5_24

IV. Lembrér, D. (Article submitted to Educational Studies in Mathematics). Parents and teachers negotiating truth statements about mathematics education for young children.

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1. Introduction

In my PhD project, I investigate parents' views on mathematics education for young children, at home and in Early Childhood Education and Care institutions (ECEC) in Sweden and Norway. The data comes from parents' stories and discussions about mathematics education for young children. These stories have provided insights into pedagogical and mathematical aspects of home and ECEC institutions that are valued by parents, how parents consider that children engage with mathematics at home and parent–teacher negotiations in respect of young children' engagement with mathematics.

My interest in this topic has arisen from my work in ECEC, first as an early childhood teacher and later as a university teacher at Malmö University, Sweden. As a teacher in a multicultural preschool, I focused on providing opportunities for all children that reflected their diverse cultures and families. In addition, my interest in early mathematics education grew, including the use of young children's experiences. As a result, I was motivated to understand parents' experiences of and views on mathematics education for young children. As first educators (Phillipson, Gervasoni, & Sullivan, 2017), parents can be considered active contributors to the mathematics knowledge and skills of their children (Hawighorst, 2005). Above all, I was interested in how parents and other family members, together with ECEC teachers, can collaborate to support children's learning and the development of their mathematics knowledge and skills. In order to achieve this, it was necessary to identify parents' views on young children's mathematics education.

A view(point) is a way of seeing the world and comes from the life experiences that people carry with them. Vázquez Campos and Liz Gutiérrez (2015) note that points of view are identified by explicit content relating to not only to what is experienced but also to what is possible. A point of view is not only a place from which people view things and events, but also the ways in which those things and events can be viewed from a certain kind of situation or position. In this project, the events described by parents are investigated from the perspective of how they see, think about and value their children's engagement in mathematics at home and in ECEC rather than as factual recall of an event. Their points of view, referred as "*views"* in

this project, are manifested in narratives about events. These narratives are the focus of the analysis, in order to determine how the parents construct and make sense of the world and create and share these views (Bruner, 1990).

1.1. The context of the project

Sweden and Norway are considered to have shared values in relation to ECEC (Vallberg Roth, 2014). In order to make the distinction clear between them, I use *förskola*[1] to refer to Swedish early childhood institutions and *barnehage*[2] for Norwegian early childhood institutions. The generic term ECEC is used to describe early childhood institutions more broadly, including institutions outside the Scandinavian context.

Vallberg Roth (2011) presents a historical review of curricula for young children from the mid-19th century to the first decade of the 2000s. She indicates that aspects of institutional practices and functions of ECEC in Scandinavian countries have shifted away from the main objectives of care, nurture and social development towards a greater emphasis on formal learning. These objectives also reflect the political goals of wider society (Vallberg Roth, 2014). The curricula indicate what a society regards as important for children to learn during early childhood education. For example, the Swedish *förskola* is based on the belief that if all children are taught the same meanings and values for a society, they will share the same core values, which is good for the society as a whole (Jönsson, Sandell, & Tallberg-Broman, 2012).

Over the last two decades, many countries have implemented curriculum documents for ECEC that include guidelines and values, expected content, and pedagogical perspectives. Such documents in Scandinavian early childhood education often

[1] *Förskola* is the Swedish term for institutions for Early Childhood Education and Care (ECEC) in Sweden, which are for children aged one to six.

[2] *Barnehage* is the Norwegian term for institutions for Early Childhood Education and Care (ECEC) in Norway, which are for children aged one to five.

describe a child-centred pedagogy, emphasising children's play, social development, active participation and exploration (OECD, 2015).

Curriculum documents in many European countries specify the need for a partnership between ECEC staff and parents (Hujala et al., 2009; Janssen & Vandenbroeck, 2018). Parents are seen as a positive force in their children's educational outcomes (Hoover-Dempsey & Sandler, 1997) and as resources during their children's education (e.g. Civil & Bernier, 2006). At the school level, schools have been documented as collaborating with families to increase families' awareness of which home activities foster children's mathematics and make use of opportunities at home (Epstein & Sanders, 2006; Sheldon & Epstein, 2005). Hujala et al. (2009) state that collaboration can take many forms in different countries. Curricula documents can also be subject to different interpretations by different groups of people, such as politicians, teachers and parents (Kelly, 2009). Thus, collaboration is not that easy to achieve given the lack of information about how to develop these partnerships in the curriculum documents.

In Sweden and Norway, ECEC curricula describe how institutions should work co-operatively with parents in order for children to receive good care and opportunities for development in accordance with their potential (Norwegian Ministry of Education, 2017; Swedish National Agency of Education, 2018). There should also be opportunities for parents to engage in and influence activities in ECEC institutions. For example, the Swedish curriculum for preschool (2018) states that:

> *in cooperation with the home, the preschool should promote the development of children to become active, creative, competent and responsible people and members of society (p. 7)*

and

> *all forms of evaluation should take the perspective of the child as the starting point. Children and parents should participate in evaluation and their views are to be given prominence. (p. 19)*

In the Norwegian Framework Plan (2017), it is stated that:

> *Kindergartens shall work in partnership and agreement with the home to meet the children's need for care and play, and they shall promote learning and formative development as a basis for all-round development. (p. 7)*

and

> *Planning must be based on knowledge of the children's well-being and all-round development, individually and as a group. It shall also be based on observation, documentation, reflection, systematic evaluation and conversations with children and parents. (p. 37)*

The Swedish curriculum and the Framework Plan in Norway regulate the content and tasks as these relate to parental engagement and cooperation within ECEC pedagogical practice. These policy documents give direction to the teachers' work in order to encourage them to plan activities in collaboration with parents. Within ECEC, teachers have the professional responsibilities of planning, leading and evaluating activities and developing children's mathematical skills. From a pedagogical perspective, children's learning and development occur between the individual children and their home environments, supported by teachers facilitating the collaboration of parents.

Regardless of the curricula, parents' views have received little attention in Scandinavian early childhood research (Råde, 2020; Vuorinen, 2020). In the existing research on collaboration between parents and teachers, the focus is rarely on the parents' views of their involvement in their children's ECEC institution (Murray, McFarland-Piazza, & Harrison, 2015). On the contrary, the research literature generally highlights how to improve children's learning at home through, for example, encouraging family members to engage in a specific way with children's learning at home (e.g. Christenson, 2004). The growing concern over preparing children for their future school activities has resulted in early learning emphasising this kind of parental involvement in early childhood education (Galindo & Sheldon, 2012). However, focusing on preparation for schooling has been criticised (Moss, 2013). Moreover, previous studies have indicated that when parents' views receive little recognition within the ECEC setting, parents are unlikely to value opportunities for engaging with their children's educational institutions (Galindo & Sheldon, 2012; Janssen & Vandenbroeck, 2018). Consequently, given the increasing

level of attention on curricula, and that parents are playing a role at an individual level, ECEC institutions do not seem to be paying attention to parents' role and they focus on parents' role in a way that leads them only to inform parents of what should be done at home.

Mathematics for young children is also addressed in the Swedish curriculum for preschool in and in the Norwegian Framework Plan. The Swedish curriculum for preschool (Swedish National Agency of Education, 2018) stresses that care, socialisation and learning should form a comprehensive whole that aims to facilitate, for example, mathematical learning through play. The goals for mathematics do note relate to things to be achieved and are not to be used to compare children but rather they guide teachers in providing each child with the most appropriate conditions to develop. These goals are:

- an ability to use mathematics to investigate, reflect on and try out different solutions to problems posed by themselves and others,
- an understanding of space, time and form, and the basic properties of sets, patterns, quantities, order, numbers, measurement and change, and to reason mathematically about this,
- an ability to discern, express, investigate and use mathematical concepts and their interrelationships (Swedish National Agency of Education, 2018, p. 15).

In the Norwegian Framework Plan (Norwegian Ministry of Education, 2017), learning of mathematics at *barnehage* is described as a process of or purpose for engaging with quantities, spaces and shapes. Therefore, the *barnehage* will enable children to:

- discover and wonder about mathematical relationships
- develop an understanding of rudimentary mathematical concepts
- play and experiment with numbers, quantities and counting and gain experience of different ways of expressing these
- gain experience of quantities in their surroundings and compare them
- use their bodies and senses to develop spatial awareness

- investigate and recognise the characteristics of different shapes and sort them in a variety of ways
- investigate and gain experience of solving mathematical problems and find pleasure in mathematics (2017, p. 53).

In the Swedish curriculum for preschool (Swedish National Agency of Education, 2018), the mathematics guidelines include certain properties and skills. Children should have the conditions to develop specific understandings (e.g. space, time, order number, problem-solving and mathematical reasoning). Lembrér and Meaney (2015) have categorised the goals and guidelines of the previous curriculum (Swedish National Agency of Education, 2011) according to how they indicate children's being and becoming by identifying the emphasis given to the production and reproduction processes of socialisation. The results indicate societal expectations as regards children needing to acquire skills to perform as members of their society and be competent members of their *förskola*. The findings suggest that the goals and guidelines were in conflict with various aspects of the curriculum (Swedish National Agency of Education, 2011). The mathematical goals show a strong emphasis on young children becoming mathematicians, which may restrict teachers' scope for planning activities that value what children already know and can do, limiting them instead to ensuring that the children become mathematicians. Similarly, Helenius (2017) considers that the kind of mathematics education children receive at *förskola* may be restricted by a focus on preparing children for school learning. Helenius raises the question of how academic-style teaching of mathematics for young children at ECEC can build on children's interests and experience.

The Norwegian Framework Plan's tasks and content are described as "learning areas" and include investigation and experiences as these relate to different shapes, sorting, patterns, quantities, spaces and solving mathematical problems. In this way, the experiences that the children have as a result of the teacher's planning contribute to the development of their mathematics knowledge and skills. The teachers are expected to encourage children to use their everyday experience to develop mathematical skills. This learning area highlights children's areas of interest

and helps them to make links with the mathematics they have already encountered (and continue to engage in) at home. Nevertheless, there are signs that academic subjects, such as mathematics, have been emphasised over equality, democracy and solidarity (Fosse, Lange, Hope Lossius, & Meaney, 2018). Mathematics education as set out in curricula documents is not exempt from being used to fulfil political goals. For example, in Norway, Lange and Meaney (2018) investigated the Minister of Education's views on mathematics education in *barnehage* on the basis of a debate article that he had written. The Minister of Education emphasised that mathematics as a subject relates not only to individuals but also provides beneficial values to Norwegian society. As Lange and Meaney (2018) suggest, mathematics education in *barnehage* and other parts of the education system has become increasingly linked to society's economic needs. This point was also made earlier by Vallberg Roth (2011), when she investigated the history of ECEC curricula in Scandinavia.

In culturally diverse societies such as Sweden and Norway, opportunities to discuss educational activities can provide an understanding of some of the meanings found in those societies (Walzer & Miller, 2007). Thus, parents' views may contribute to the research and political debate that contribute to broadening the understanding of young children's mathematics education. Nevertheless, much remains unknown about parents' views, which this project seeks to redress.

1.2. Aim and research questions

In this project, I aim to develop knowledge about parents' views on mathematics education for young children as a way of filling in the gaps in the empirical knowledge regarding what is known about parents' views on mathematics education. An underlying assumption of the project connected to curricula for early childhood in Scandinavia is that parents' views should be incorporated into young children's education. Parents' views can inform early childhood teacher education, as well as teacher-parent collaboration in ECEC institutions. Four sub-studies, which led to the four articles in this thesis, were conducted to achieve this aim. The overall research questions of the thesis are as follows:

How can parents' views on mathematics activities for young children be identified?

What do parents' value in mathematics education for young children?

What might influence parents' views on mathematics education?

This project consists of four articles and a *kappe*. A *kappe* is a text intended to give a comprehensive overview of the whole PhD project and to answer the overarching research questions. A *kappe* explains the connections between the articles included in the thesis and brings together the aim, results and conclusions of the project. The overall research questions of the thesis are addressed by four sub-questions that correspond with the four articles:

i. What insights do immigrant parents' views about mathematics in Swedish preschools and at home provide about socialisation processes? (Article I)
ii. What are the advantages and disadvantages of using photo-elicitation focus group interviews to gain insights from parents about mathematics education at home? (Article II)
iii. What do parents value in the mathematics activities that their children engage in at home? (Article III)
iv. How do parents and teachers express their views and how do these views come to be valued in parent-teacher interactions? (Article IV)

1.3. The outline of the thesis

In addition to this introductory chapter, the *kappe* includes five further chapters. Chapter 2 describes previous research on early childhood mathematics education in ECEC and early mathematics skills at home. Chapter 3 elaborates on the theoretical framework for understanding the factors that influence parents' views. Chapter 4 focuses on the methodology, research design and discussion of data collections, analysis, validity and reliability. Ethical considerations are also addressed. Chapter 5 discusses the project's findings with respect to the overall research questions. The implications, as well as limitations and concluding remarks, are considered in Chapter 6. These chapters are followed by the references and appendices. The four original sub-studies are presented in the last chapter of the thesis.

2. Parents and mathematics education for young children

In this chapter, I discuss the previous research into parental roles in children's mathematics education and the collaboration between ECEC staff and parents, including immigrant parents. This discussion adds to the literature reviews in the four sub-studies. The chapter is organised according to three themes: 1) mathematics education at home, 2) mathematics education in the ECEC-to-home direction; 3) and collaboration on mathematics education at home and school. These themes provide insights into the complexity of what is known of parental views on mathematics education for young children.

2.1. Mathematics education at home

The roles that parents play and the ways they contribute to early childhood mathematics are seen as providing a world of opportunities in terms of mathematics activities that children can engage in at home (Sullivan, Gervasoni, & Phillipson, 2017). However, studies have shown that parents' views on children's mathematics development and their roles in fostering it relate to their views on the importance of children engaging in mathematics, how children learn, parents' roles in their children's mathematics education and their schooling (Green, Walker, Hoover-Dempsey, & Sandler, 2007; Sonnenschein et al., 2012).

The involvement of parents in their children's mathematics education is considered an important element in ensuring that they achieve appropriate academic outcomes (Press & Hayes, 2000). Sheri-Lynn, Sowinski, and LeFevre (2014) found that parents engage in both formal and informal mathematics activities with their young children. These two forms of interaction focus on aspects of symbolic number knowledge. Informal home mathematics activities, such as when parents highlight number symbols or counting objects, seem to contribute to children's early mathematical skills, which contribute to their achievement at school (Mapp, 2003; Missall, Hojnoski, Caskie, & Repasky, 2015). Such outcomes are consistent with much of the previous research into the relationship between how parents facilitate

children's early numeracy skills and later school outcomes (see for example, Anders et al., 2012; Dunst, Hamby, Wilkie, & Dunst, 2017).

Studies have shown that parents have the background necessary to engage in informal mathematics activities at home, such as playing games, reading stories and exploring mathematics content when cooking. Aubrey, Bottle, and Godfrey (2003) documented that children's early numeracy experiences at home are evident in various everyday activities, such as counting snacks, reading, number games, cooking and playing card games. Similarly, Lefevre and colleagues (2009; 2010) found that parents consider that getting children involved in playing board games or cards, cooking or shopping supports their learning and development in mathematics. These informal activities build on activities in everyday life.

In another study, Clarke and Robbins (2004) had parents take photos of their children's numeracy activities at home and in their neighbourhood. The photos show games, playing with money, sorting, children measuring ingredients and cooking. The photos show what the parents identified as mathematics in everyday life experiences. At the same time, the parents reported becoming more aware of the numeracy experiences their children engaged in through their involvement in the project. This suggests that a collaborative project with ECEC institutions may be informative for both ECEC institutions and parents.

Parents have a broad range of professions and levels of education, as well as differing in other ways, such as their social or cultural status. Therefore, as Cannon and Ginsburg (2008) found, parents engage in children's mathematics activities to the degree this is comfortable or that they feel their ability allows. Other research found that parents involve their children in mathematics activities at home according to their underlying beliefs and expectations (see for example, Lefevre, Clarke, & Stringer, 2002). In Skwarchuk's (2009) study, some parents reported being unsure about conveying numeracy concepts to their children. This uncertainty can lead to their children missing out on mathematical experiences at home, as parents who place more value on the importance of mathematics tend to engage in mathematics activities with children more frequently while other parents seem to avoid engaging in mathematics activities.

Although parents' abilities to support their children's mathematics learning at home have been investigated to some degree (Anderson, Anderson, & Shapiro, 2005), this research has focussed mostly on young children developing numeracy skills and the impact of this on school outcomes (Colliver & Arguel, 2018; Harris & Goodall, 2008; LeFevre et al., 2009; LeFevre et al., 2010). For example, it has been found that learning numeracy at home is related to parents' use of number words and elicitation of number talk from children. By observing a child's everyday activities during their first six years of life, Björklund and Pramling (2017) found that interactions between children and adults can support children's mathematics development. In a study set in schools, Civil, Guevara, and Allexsaht-Snider (2002) investigated the role of low-income, Latino parents' understanding of mathematical concepts in supporting their children's learning of mathematics. The parents attended courses in mathematics to learn about concepts related to fractions. However, the results showed that the parents' knowledge of mathematics was not necessarily the most important element in respect of the children learning mathematics. What was more important was that they were able to talk with their children about the specific concepts. Conversation with their parents helped the children to move forward in their mathematical development.

Therefore, parental knowledge and skills are valuable in so far as Kaur (2010) suggested, "creating strong links between families and early childhood settings extends children's learning, fosters a sense of community and acknowledges the expertise of families" (p. 53). Parents' views on mathematics education can provide insight into the diversity of childhood and how parents support their children, especially when it comes to learning basic mathematics concepts (see for example, Hawighorst, 2005). By hearing about home experiences, ECEC teachers have access to a broader understanding of mathematics education for young children. Teachers then have the opportunity to use a wider variety of children's everyday experiences to develop their mathematical skills, such as in a study by Carruthers (2006) which discusses early years teaching in which children made links between the mathematics they encountered at home and at the school.

2.2. Mathematics education in the ECEC to home direction

Most of the research relating to parents' and teachers' collaboration in ECEC institutions has investigated how teachers in ECEC support parents in better understanding mathematics-related opportunities for young children (e.g. Anders et al., 2012; Blevins-Knabe et al., 2000). In these discussions, the parents are situated as the recipients of knowledge. Interventions of this kind are often connected to concerns that some parents avoid mathematics and that young children's early learning of mathematics needs to be enhanced (e.g. Sénéchal & Young, 2008; Siegler & Ramani, 2008). These studies are reinforced by research showing that mathematics activities in which children take part in their first years of life may be beneficial for school achievement, not only in mathematics but also in other subjects such as reading (Duncan et al., 2007).

Such intervention studies focus on broadening the opportunities for parents to support their children's development of early mathematics skills (e.g. Blevins-Knabe et al., 2000), such as by providing them with materials (e.g. Sheldon & Epstein, 2005). Sometimes, these interventions resemble the everyday activities at home, such as playing with board games that have been designed specifically to improve children's early numeracy skills (Young-Loveridge, 2004). Other studies also provided specifically designed activities that resemble activities previously identified in the home. For example, Streit-Lehmann's (2017) study in Germany investigated how ECEC institutions can support parents by lending them books and games with mathematics-related content. The activities were designed to encourage families to support their children's learning of mathematics such as counting, comparing, number words and symbols. Although the results of this study broadened the understanding of how ECEC teachers can help parents to work with mathematics at home, it was the researchers' and teachers' expertise that was used to enhance the parents' awareness of their children's learning of mathematics. These kinds of interventions may not prioritise the incorporation of parents' views on their children's mathematics activities as required by the Norwegian Framework Plan (Norwegian Ministry of Education, 2017) and Swedish curriculum (Swedish National Agency of Education, 2018).

2.3. Collaboration on mathematics education at home and in ECEC

In the under-researched field of parents' views on mathematics education for young children, there has been virtually no research on parents and ECEC teachers collaborating on equal terms. Although curricula documents require regular collaboration, the lack of collaboration may be linked to the different roles that parents and teachers play in children's lives and to contextual considerations that may interfere with opportunities for such collaboration.

Lightfoot (2004) drew attention to how families and teachers form relationships according to their different roles in children's lives. However, these different roles may hinder collaboration, as, in the dialogue with ECEC staff regarding their practices and early education policy, it seems that parents' views may be missing (Van Laere & Vandenbroeck, 2017), because the teachers feel that they have a professional responsibility to determine what happens in their ECEC institutions.

Although Perry and Dockett (2002) stressed that teachers' professional work includes understanding the mathematics that children bring to their ECEC institutions, ECEC teachers are not always open to valuing parents' views on mathematics education. Björklund and Barendregt (2016) found that the knowledge valued by teachers generally related to what they recognised as an aspect of their own pedagogical practice. Thus, parents' views that were not in alignment with those already known and valued by the teachers could not be included in the activities at the ECEC institutions. Similarly, Wager and Whyte (2013) investigated ECEC teachers' views on using children's home experiences in ECEC. They found that the teachers made use of home experiences in two different ways. Some of the teachers recognised only familiar opportunities for learning mathematics that allowed them to continue working in the same ways in ECEC. Other teachers were able to incorporate unfamiliar opportunities for learning from the children's home environments into planned activities. Wager and Whyte's (2013) study raised questions about whose ideas might underpin opportunities for learning mathematics and about whether and when children's interests might be a source of activities. Nevertheless, this research suggests how collaboration between parents

and ECEC may contribute to achieving the aims set out in the curricula (Norwegian Ministry of Education, 2017; Swedish National Agency of Education, 2018).

In order for parents' views to be heard and accepted as valuable, it is necessary to negotiate the collaboration between parents and teachers (Dahlberg & Moss, 2004; Hughes & MacNaughton, 2000). Opportunities for collaboration often depend on the context, such as the parents' familiarity with the educational institutions. For example, research in schools shows that immigrant parents may struggle to become involved in the educational institutions in their new countries (Lunneblad & Johansson, 2012). An Italian study by Giovannini and Vezzali (2011) focused on how and whether contact between teachers and immigrant parents affected children within an educational setting, such as in elementary schools. Where teachers have positive attitudes towards parents, this improved relationships within the school (Giovannini & Vezzali, 2011). Van Laere and Vandenbroeck (2017) stressed how the inclusion of minority group perspectives can reveal and address the similarities and differences in teachers' and parents' views on early childhood education. Such inclusion can expand the connections between children's opportunities to engage in mathematics at home and in ECEC.

In Australia, Díaz (2003) raised issues about bilingual children's experiences of negotiating identity and suggested that, in ECEC, children negotiate social and cultural identity, by incorporating elements of all the norms, values, cultures and languages they come into contact with. This included recognising identity and common origin or characteristics shared with another person or group. In contrast, the results of research by Civil, Bratton, and Quintos (2005) into mothers in a Spanish/Latino community in USA suggested that experiences connected to the use of different languages may have an impact on opportunities for collaboration between parents and teachers. Where teachers are unfamiliar with parents' languages and cultures, this may affect the way that children recognise and value their parents' knowledge, including in their experience of mathematics at home. The use of a different instructional language may reduce children's interest in identifying with their home language and cultural experiences, including in their views on mathematics. As a result, children may have difficultly talking with their parents

about schoolwork. Research by Civil et al. (2005) identified differences in teachers' and parents' approaches to mathematics. Immigrant parents may bring views on mathematics different to those familiar to teachers. Similarly, children's school mathematics practices may be unfamiliar to their immigrant parents. Parents' views may also enable ECEC teachers to move away from notions that cultural groups are homogeneous (Díaz, 2003) and provide them with opportunities to incorporate aspects of children's different home experiences into mathematics education.

Collaboration between parents and ECEC teachers is built on their understanding of mathematics, and different views on mathematics may hinder opportunities for collaboration. Mathematics as a subject is politically valued (e.g. Keitel, 2006; Lange, 2019; Lange & Meaney, 2018). For example, government policy on early mathematics education may be emphasised in discussions about changes to curricula in Norway (Lange, 2019; Lange & Meaney, 2018) or by government-mandated professional development programmes in mathematics for teachers in *förskola* in Sweden (Björklund & Alkhede, 2017; Helenius et al., 2017). As such, the political debate and outcomes of mathematics education research may affect both teachers' and parents' views on mathematics education, but not necessarily in the same way.

Collaboration between parents and teachers is a requirement in many ECEC curriculum documents worldwide. However, this collaboration may be influenced by a range of contextual factors, such as language and families' social and cultural backgrounds, including differing views on what mathematics education for young children is. For example, societal views on the importance of numeracy may influence parents' views on mathematics for young children (e.g. Vasilyeva et al., 2018).

2.4. Chapter summary

In this chapter, I have discussed three themes to frame previous research into parents' views on mathematics education for young children. Previous research has identified how parents engage children in mathematical ideas through everyday experience. This can inform research about how getting parents more involved in ECEC practices may be beneficial for children's learning and development, including

their educational outcomes at school. However, in recent years, most intervention studies have focused on informing parents about good activities to do at home and there has been little research into how collaboration can occur on a more equal basis that also values the experience of parents. Some earlier research also illustrates how certain contextual features, such as the different roles of parents and teachers, may hinder equal collaboration.

3. Theoretical framework

In this chapter, I present Bruner's (1991, 2006) theory of narrative construction, which provides an overarching framework for identifying and investigating parents' views on mathematics education for young children. Bruner (2009) argues that people's narratives are constructed from their experience as a primary way of making sense of the world around them (Bruner, 2009). The narrative construction thus provides links between people's views and the cultures that are created and negotiated within a society.

In this chapter, I describe how the theoretical frameworks used in Articles I–IV relate to Bruner's (1991, 2004, 2006) theory of narrative construction. In each article, there are further details about the individual theoretical frameworks. In this chapter I have not repeated this information but focus instead on the relationship between the frameworks and Bruner's framework.

3.1. Narrative construction

Bruner (1991) stresses that narrative construction should be understood as universal, where the personal view is constructed and reconstructed through social interactions and cultural activities. As discussed in Chapter 1, parents' views on mathematics activities for young children are considered to be social constructions. Investigating parents' views from the narratives that they tell provides opportunities to understand how individual views draw on the values and norms of their societies.

Bruner states that a narrative is about "the desire to communicate meaning" (Bruner, 1990, p. 8) and that people use narratives to construct and make sense of their views of the world. As such, he emphasises the importance of language as a tool for understanding the world. It is through narratives that people build up a view of themselves and their place in the world. Narratives can be considered a way to understand how culture offers people established ways of acting and provides a way to interpret and negotiate societally expected norms of behaviour, differences of meaning and views. Bruner's view of culture suggests that in a society, people understand knowledge and values from multiple perspectives, incorporating some but not all of these within their own views. Culture provides a way of negotiating the

ordinary and the exceptional as a part of the ongoing process of making sense of the world.

It is through the telling of narratives that society provides its members with models of identity and descriptions of patterns of actions and events (Bruner, 1990). Narratives are not only a form of describing events that have happened but also a form of thinking and a structure for organising knowledge. People order their own experience and views in narratives, which then allow them to make sense of the experiences of others in everyday life. Thus, a narrative is more than just a description of actions or events: it is affected by the way in which meaning, memory and cultural forms are interwoven into the lived experience through everyday interactions, concerns and cultural influences (Bruner, 1991). A narrative is situated in the context of its time and provides a sequence of events with an interrelated, meaningful connection, which allows for the reasons behind these events to be interpreted. Bruner stresses that:

> *The loose link between intentional states and subsequent action is the reason why narrative accounts cannot provide causal explanations. What they supply instead is the basis for interpreting why a character acted as he or she did. Interpretation is concerned with 'reasons' for things happening, rather than strictly with their 'causes' (Bruner, 1991, p. 7).*

By constructing a narrative, a person provides an opportunity for others to interpret what someone has said so they can determine what this person meant: to proceed from what seems to be the case to what the case is about from the interpreter's point of view. For Bruner (1990, 2004), narrative construction provides insight into how the tellers of narratives view ways of thinking, ways of constructing meaning and ways of experiencing the world.

Bruner's narrative construction can provide insight into parents' views on mathematics education for young children. The narratives are a retelling of a set of events that parents are making sense of. Regardless of whether the narratives indicate that they themselves have engaged in their children's mathematics activities or that they are merely telling a story about them, the parents provide a point of view. In the retelling of events, the narrative will include some details that the tellers

consider essential, while leaving out others that they consider not to contribute to their listeners' sense-making. A joint construction of narratives also highlights how views on mathematics education are negotiated and how others recognise them as parents. On the other hand, teachers' views are likely to be interpreted differently because of their position in society and not only because they tell different narratives. As a result, the views on mathematics education in parents' narratives are subjective interpretations of events in their lives and not objective facts.

3.2. Socialisation – societal norms and values

As discussed in the previous section, Bruner states that culture offers people ways of acting from a multitude of possibilities and provides a way to interpret and negotiate the expected norms and values of society. In my first sub-study (Article I), I analysed the responses to open-ended questions in a survey of Polish immigrant parents on their views of mathematics activities at Swedish *förskola* and at home from the perspective of socialisation, with a focus on norms and values. Although narrative construction was not the theoretical background for this article, the analysis of the responses to the survey assumed that Polish parents were meaning makers. In the way that Bruner had outlined, who had experiences to relate about their children's engagement with mathematics education in Swedish *förskola*.

To analyse the survey responses, I used the definition of socialisation from James, Jenks, and Prout (1998), which focuses on how societal norms are transmitted from one generation to another to ensure that societies sustain themselves over time. As described in the first article, societal norms become evident in how parents interpret their world.

The connection between socialisation and narrative construction can be seen through Bruner's concept of culturalism. Bruner (1996) does not use the concept of socialisation but instead refers to *culturalism* as a system of values, rights, opportunities and power. Culturalism explains how what is valued by the system affects those who must operate within that system. By analysing parents' views on mathematics activities and what influences these views, Bruner's understanding of culturalism can be related to socialisation. Culturalism focuses on the interaction between the power connected to a person's views and to the views that a society

promotes. Culturalism also relates to the societal provision of education and who benefits from this. Bruner (1996) stresses that education is a part of society and plays a role in the lives of those who live within that society. Education serves specific functions and reflects the status, benefits and other aspects of society members. Culturalism raises questions about which opportunities and resources are made available to members of society through education.

Culturalism can be connected to frameworks for socialisation processes in early childhood research into children's development of skills connected to their own and others' roles in society (Prout, 2011; Qvortrup, 2005). Prout's (2011) and Qvortrup's (2005) definition of socialisation as a process of creating and recreating society and transmitting culture includes the potential influence of the meanings to be found in that society. Although the societal norms and values identified in Article I are, to some extent, predominantly about reproduction, socialisation can also show how societal norms and values are changed or how new ones are created. As "cultural" readers of Swedish societal norms and values, the Polish parents' responses provided insights into their own and their children's socialisation into Swedish society as well as whether they consider these norms and values to be adaptable or static.

As described in Article I, I recognise the socialisation processes as being central to understanding the sense that Polish parents were making when they explained particular pedagogical aspects of mathematics activities at *förskola* and at home. As they described their children's experiences, they drew on society's norms and values, including those norms and values evident in their children's experiences at *förskola*, to make sense of their experiences of mathematics. In this sense, the socialisation processes may have influenced the parents' views of mathematics education for young children by adjusting their views to match those of the new society in which they were living.

3.3. Bourdieu's lens of the field

The underlying assumption of this project is that parents communicate their views during interactions with others. Therefore, it was important for me as a researcher to reflect on how the photo-elicitation focus group interviews were affected by the

participants' social situations. In Article II, Bourdieu's theoretical lens of the field (Bourdieu, 1975; Bourdieu & Wacquant, 1992) was used to explore the use of photo-elicitation interviews as a method for gathering data (Chapter 4 provides further discussion of the methodological choice of photo-elicitation focus group interviews – see section 4.4.).

Bourdieu (1996) defines the field in which people (agents) operate as being determined by the material resources of power and capital of those agents:

> *The field of power is the space of relations of force between agents or between institutions having in common the possession of the capital necessary to occupy the dominant positions in different fields (notably economic or cultural)* (p. 215).

Each agent's position in the field is defined according to the field's specific rules. This is dependent on the resources and knowledge, which Bourdieu defines as capital, that the agents have. Capital refers to the variety of resources, visible and invisible, with which an agent can achieve "success" in the field (Bourdieu & Wacquant, 1992). Bourdieu believes that the dominant forms of capital, operationalised in interactions between people, require acknowledging the diverse forms of capital present within a group. Cultural capital includes the value of knowledge and education and plays a role in people's experiences in society. Social capital places the emphasis on how people encounter and are challenged by different contexts in society. For Bourdieu (1986), there are distinctions in how social capital and cultural capital are seen: not as overlapping resources but as hierarchical resources within the valuing of knowledge.

The value of parents' social capital is in their diverse views and ways of understanding mathematics education. However, if these resources are not valued within the wider society, then the parents will have little opportunity to act within that field. Given that it was likely to be a new experience for the parents to be asked to discuss their views on the mathematical activities that their children engaged in, it was important to understand that they could be supported by relating narratives that allow them to express their views. Reflecting on what kinds of capital were valued in the focus group interviews raised questions about how the participants could determine what might be seen as worthy of telling.

For Bourdieu, power is connected to high-status resources to which only some people and groups have access. Bourdieu describes indications of privilege and how, when they are absent, barriers are set against the inclusion of some types of experience. Thus, views on mathematics education for young children may be considered more or less powerful forms of knowledge, depending on the field in which they are shared. For example, a facilitator can draw on cultural capital from their academic knowledge or qualifications that can erect barriers to parents being willing to relate narratives of their own experiences.

The academic knowledge of a researcher who acts as an interviewer is not a neutral resource; it is linked to social capital, which draws on networks of relationships, shared understandings and recognition (Bourdieu, 1986). As social and cultural capital are not necessarily equally valued, the value assigned to this resource depends on a researcher's status. In my study, it is assumed that the parents' and my own cultural capital affected our interactions. The parents' or researcher's cultural capital appears in how they make use of their sense of self and ways of thinking and interacting. For example, in the interview situation, the parents might highlight the differences between themselves and others while also attempting to bridge those differences as at value is added to their views.

Bourdieu's notion of a field is situated in the construction of culture. It can thus be linked to Bruner's (1996) culturalism, which considers the resources made available to people through education. In order to gain insights into what parents' views are for the current project, it was essential to understand how these views are constructed in social interactions and cultural activities within lived experiences in society (Bruner, 1991). This was the basis for conducting the analysis that led to Article IV.

For this project, Bourdieu's notion of power helped me as the researcher to think about the possible practices that allowed the parents to share their knowledge of mathematics education in the focus group interviews. As a consequence of conducting the study for Article II, it became important to raise the question of what influences parents as "creators" of knowledge about mathematics education for young children.

Parents' opportunities to tell narratives are discussed in Chapter 6 in the section on methodological implications. Section 6.2 discusses findings that recognise the value of social interactions and the consequences of parents and ECEC teachers sharing and exchanging views on mathematics education for young children.

3.4. A narrative approach to learning mathematics

In order to explore the value that parents attach to mathematics activities that children engage in at home, I analysed interactions between parents in photo-elicitation focus group interviews (see Chapter 4 for an in-depth description of this data collection). In Article III, I adapted Burton's four aspects of narratives on mathematics learning. Burton (1999, 2002) suggests that narratives about children's actions when doing mathematics have four aspects: authoring, sense-making, collaborating and using non-verbal communication (these aspects are described in more detail in Article III).

Like Bruner (1990), Burton stresses that narratives play a central role in experiencing the world and, therefore, Burton applies the narrative approach theory in order to explain how and why mathematics is taught and learnt (Burton, 1999). For Burton, a narrative approach is appropriate when learning and developing mathematics knowledge, and skills are accepted as the active construction of meaning. Burton (1999, 2002) states that a narrative approach is helpful when exploring children's learning experiences as it gets them involved in describing their experience of learning mathematics. This is in alignment with Bruner (1991), who considers that narratives are constructed about a sequence of events (activities) and include an indication of the views on the activities/events described. It is the narrator's views that can be explored because it is the narrator who tells the narrative.

Although Burton's narrative approach to learning mathematics addresses children being active in storytelling relative to their experiences and understandings, I found Burton's (1999, 2002) theory to be useful for understanding parents' views on mathematics education. This is because the adults around children, such as parents and teachers, have their own views on children's learning which may be different to those of the children themselves. In the interviews, the parents' produced narratives

about what the mathematics might be in their children's activities and the mathematics learning that was valued in their home environments. Through the construction of narratives, parents structure and give value to what they have seen children engaging in in their home environments, which is in alignment with Bruner's (1990) description of narrative construction.

Therefore, narrative construction provides a tool for analysing the meaning of the participants' experiences and understanding what contributes to the construction of views in the meaning-making of events. Chapter 5 further discusses these findings of the current project as they relate to developing an understanding of parents' views on mathematics education for young children.

3.5. Foucault – understanding of power/knowledge

As the project progressed, it became important to investigate how parents and teachers discussed mathematics education for young children. To undertake this analysis, Foucault's understanding of the relationship between power and knowledge (1980a) was combined with Bruner's narrative construction. The narratives from Bruner's framework offer opportunities to reveal meanings and expose the assumptions of society. Parents' and teachers' experiences with mathematics for young children were described in narratives. Bruner (1996) states that social contexts influence people's actions and, therefore, their narratives. Foucault (1982) describes how power and knowledge act together to highlight how certain views come to be valued within a changing dynamic interaction. Consequently, Foucault seemed a more appropriate choice for analysing the interactions than Bourdieu, whose work had been used earlier to understand the researcher's role in the focus group interviews.

According to Foucault, within every argument, reasoning and reflection, there is always a certain statement or view that provides a value statement rather than an explanation (Foucault, 1982). A value statement, which I equate with a view, refers to knowledge brought into interactions between people. Importantly, Foucault highlights that in interactions between people, views can be negotiated. Foucault stresses that negotiation exists within relations of power, highlighting that power is not a thing that is exercised on one person over another. Instead, Foucault states

that the efforts to justify knowledge, based on its origin and the interaction's purposes, become a way of exercising power (Foucault, 1982).

Foucault (1980a) describes power and knowledge as being related, because when certain knowledge is considered valuable, it can then control what is accepted as the truth within an interaction. At the same time, for power to be exercised, a certain kind of knowledge needs to be accepted as valuable. Therefore, power circulates within situations, such as in the interactions between parents and teachers, when a certain kind of knowledge about mathematics education comes to be valued by the wider group as a truth statement. The relationship between power and knowledge is built on how parents and teachers construct joint narratives in an interaction that can lead to a participant adopting a new view or reinforcing an existing personal view. The participants, coming from different positions within society, had different views on mathematics education, which were reflected in their narratives. Through negotiation, these views were reinforced, discarded or adapted at both the individual and the group levels. Thus, a view can contribute to, as well as be a result of, social interaction. Power and knowledge are present in relations between persons and societies when something is being negotiated. The interactions between parents and teachers included navigating between their experiences and the established reasons given for mathematics education for children. The context of their experiences may affect what will become their views on mathematics education. Their roles also determine how they accept someone else's point of view or negotiate the value of a certain kind of knowledge.

The narratives of teachers and parents are influenced by their social and cultural backgrounds and how the teachers and parents interact with each other. Bruner (1990) states that narratives provide evidence of people's views based on their personal experiences in their everyday lives. The experiences that the narratives elicit also assign a specific value to their views. In the interactions during the photo-elicitation focus group interviews (PEIs), parents and teachers negotiated the value of their individual or group knowledge of mathematics education. The parents and teachers determined through this negotiation what knowledge was accepted as statement of truth. Their interactions, documented in Article IV, showed that power

and knowledge circulated between them (Foucault, 1980a). Bruner's narrative construction provided insights into what was valuable in the participants' experiences of the mathematics education of young children.

3.6. Chapter summary

In this chapter, I have described how the different theoretical frameworks used in the project relate to Bruner's (1991) narrative construction, focusing on how meanings ascribed to their experiences of mathematics education for young children communicate a view.

Bruner's narrative construction provides an overarching theoretical framework for all the sub-studies, either explicitly or implicitly, as it provides insights into the contribution of parents' lived experiences in society to their narratives. The narratives provide information about personal views and, as such, these narratives are socially constructed. The theoretical framework of narrative construction allows parents' views to be seen as being influenced by societal norms and values, rules and regulations. Each sub-study emphasises parents' views as parts of constructed narratives about mathematics education for young children. The societal norms and values that Polish parents made sense of contributed to an understanding of their views on mathematics education (Article I). The mathematical learning opportunities at home were identified in the parents' narratives about children's experiences of mathematics education in their everyday lives (Article III). Societal expectations and influences found in the narratives of the PEIs were discussed in relation to what in mathematics education for young children is valued and how it is valued, and particularly what might influence parents' views (Articles III and IV).

The theoretical framework and previous research into early childhood provide a background for the research design and an analytical tool for reflecting on this project's findings. In the next chapter, the research methodology and analysis of data are described.

4. Methodology

In this chapter, I describe the research paradigm underlying this project and then provide information about the data collection and data analysis used to answer my research questions. Transparency regarding the choices that I have made for this project has been important as the project developed over time. Ethical considerations are discussed at the end of the chapter.

4.1. Research paradigm

All of the research has been based on underlying assumptions about what constitutes research and what methods are appropriate for developing knowledge (Robson & McCartan, 2016). A researcher's choice of paradigm depends on how they see themselves in the world around them and their views and thoughts (Bryman, 2012; Hollis, 2002).

The aim of my project has been to gain insight into parents' experiences of mathematics education for young children. In the project, therefore, I interpret the world but recognise that this interpretation is influenced by context, as well as by the emotional and social factors that affect the participants (Morgan, 2014). Consequently, it is assumed that the parents' narratives in the surveys and the focus group interviews emphasise particular aspects of their experience due to the questions that are asked and the contexts in which they are asked.

As discussed in the previous chapter, Bruner's (1991, 2004) theory of narrative construction was chosen as the overarching theoretical framework because it focuses on the insights that can be gained into the relationship between the participants' views and the contexts in which they tell their narratives. As a researcher, I identify the parents' views in order to answer my research questions.

The narratives told by the participants in the surveys and in the PEIs are the products of their sense-making of their experience of young children engaging in mathematics. These experiences, as well as others shared about social interactions in their everyday lives, were connected to others' stories. In Chapter 5, I respond to the first research question by reflecting on how the parents' views on mathematics education can be identified.

4.2. Data collection

The data was collected in Sweden and Norway. Two methods were used: an online survey and photo-elicitation focus group interviews (PEIs). These different ways of gathering data were chosen because they provided opportunities to identify the participants' views. They also provided responses appropriate for the individual studies and allowed me to respond to the overarching research questions of the wider project.

A survey at the beginning of a project is often considered useful for gaining an overview of an issue before going on to obtain more in-depth information by way of methods such as photo-elicitation focus group interviews (PEIs) (Hurworth, 2004; Lapenta, 2011; Torre & Murphy, 2015). When the project began, the focus was on the views of immigrant parents and therefore the survey was designed for this group. However, the focus changed when no immigrant parents agreed to participate in the PEI project. Nevertheless, immigrant parents have remained an important focus and their responses have informed the understanding of the influence of the wider societal context (see Chapter 5). Surveying Polish immigrant parents in Sweden provided opportunities to gain insights into their experience in both their home countries and their new countries, in line with research by Takeuchi (2018), for example.

The photo-elicitation focus group interviews comprised the second phase of the data collection. These interviews yielded narratives jointly constructed by the participants and provide insights into other aspects of how societal values and norms affected their individual views.

An overview of the data is given in Table 1 and includes the method, data material and a description of the participants. As discussed later, not all of the data was used in this project; I intend to utilise the remaining data in other articles at a later point in time. The first column shows the research methods in the order that they were used. The second includes information about data collection methods. The third presents information about the survey respondents and the participants in the PEIs.

Table 1: Overview of data collected

Method	**Data material**	**Specification of participants**
Online survey	Participant responses to 16 survey questions	41 Polish immigrant parents living in Sweden
Online survey	Participant responses to 16 survey questions	64 Polish immigrant parents living in Norway
Photo-elicitation focus group interview	60-75 min x 2	9 parents
	55 min x 2	11 teachers
	30–45 min x 3	13 participants (parents and teachers in mixed groups)

Some of the data, such as the responses from the online survey of Polish immigrant parents living in Norway and the PEIs with teachers only, have not been used in this thesis. The teacher PEIs were analysed by others in the research group and the findings reported in Fosse, Lange, and Meaney (2020). An article is in progress in which the results of a survey of Polish parents in Norway are compared with the Swedish survey responses.

The following sections discuss the data collection methods for Article I (section 4.3) and Articles II, III and IV (section 4.4).

4.3. Online survey

The use of surveys for data collection is a common technique for focusing on a specific population sample. Surveys can be conducted within a limited period of time and are thus cost-effective for collecting data (Trost, 2012). In recent years, the increasing accessibility of online surveys means that they have come to be commonly used (Cohen, Manion, & Morrison, 2000). The purpose of my survey questions was to learn parents' individual views and understand how these views

were affected by socialisation processes. My findings are presented in Chapter 5 and Article I.

The survey consisted of 16 questions. The majority were open-ended and two were multiple-choice. Table 2 presents the four types of information that were collected and analysed in Article I: background information (5 questions), views on mathematics activities (5 questions), multiple-choice questions about mathematics activities undertaken at home and *förskola* (2 questions) and experience of and views on learning mathematics and language (4 questions).

Table 2: Justification of the choice of survey questions

Survey questions	**Reasons for being asked**
Part 1, questions 1-5 asked for background information, gender, age, number of years living in Sweden and experience of attending ECEC in respect of both the parents themselves and their children.	These questions were asked to ensure that the Polish parents had experience of ECEC in Poland and/or *förskola* in Sweden.
Part 2, questions 6-10 asked parents to describe their experience of learning mathematics and describe the mathematics activities their children engaged in at home and in ECEC.	These questions sought to identify the societal norms and values that affected the Polish parents' views on mathematics activities in ECEC.
Part 3, questions 11-12 asked parents to identify the mathematics activities their children did at home and at *förskola*.	The multiple-choice questions were to find out whether the parents felt that their children engaged in the same kinds of mathematics activities at home and at *förskola*.
Part 4, questions 13–16 asked parents to describe their views on learning mathematics and language.	These questions were asked to find out whether the parents valued

	language learning more than mathematics learning.

The questions in Part 1 were used to ensure that the survey participants met the demographic criteria for the target group. The most important criteria were the parents' country of origin and experience of their children attending an ECEC setting in Poland and/or Sweden or Norway. Polish parents were chosen as participants because Polish citizens are one of the largest immigrant groups in both Sweden and Norway. As noted in Article I, Polish citizens were the fourth-largest immigrant group in Sweden in 2015.[3] In Norway, they were the largest group in 2016.[4]

The questions in Part 3 were based on previous research (Aubrey et al., 2003; Bottle, 1999). The questions in Part 4 were based on previous research by Civil et al. (2005) and Giovannini and Vezzali (2011), which indicates that some parents of young children consider literacy more important than mathematics.

The survey was placed on an online platform, SurveyPlanet (https:/www.surveyplanet.com/). SurveyPlanet allows users to design their own survey. The number of questions and responses is unlimited and it is possible to message respondents about its aim. It was possible to share a link to the survey on social networks and to display the results in a range of ways, such as by participant or question or as a summary of the whole survey. The survey allowed parents to remain anonymous, making it an acceptable data collection method for this group of participants.

The survey questions were available in Polish, Swedish and Norwegian. I wrote the questions in Polish, a language in which I am fluent. The Swedish survey was opened

[3] Statistics Sweden avaible at https://www.scb.se/hitta-statistik/artiklar/2016/Finland-och-Irak-de-tva-vanligaste-fodelselanderna-bland-utrikes-fodda/

[4] Statistics Norway avaible at https://www.ssb.no/sosiale-forhold-og-kriminalitet/artikler-og-publikasjoner/stadig-mest-innvandring-fra-polen

in June 2016 and closed in November 2016. For Polish parents living in Norway, the survey was opened in May 2017 and closed in September 2017. The surveys were kept open to gain as many participants as possible. In the first online survey, 41 Polish immigrant parents living in Sweden participated. In the second, 64 parents living in Norway participated.

Although Poles are one of the largest immigrant groups in Sweden and Norway, making contact with Polish parents proved difficult. In Sweden, contact was made with a Polish organisation (Polonia Info) and an internet forum (Polacy w Szwecji) for Polish citizens living in Sweden. The organisation and forum are platforms where information of various types about living in Sweden is provided, such as tax, the labour market, childcare, the healthcare system and the education system. The forum is for Polish citizens who plan to move from Poland to Sweden or who have already done so. As it included Polish parents living in Sweden who had children attending *förskola*, an invitation to participate in the survey, including the web address, was posted on the forum. The post was updated six times. In Norway, I contacted the chair of the Polish organisation Moja Norwegia and asked them to publish the web link to the survey and information about the study on the organisation's website. I was not an active member of any of these organisations. Although use of the online forum for approaching parents did provide sufficient data, the way the participants were approached means that they may not be a representative sample of the Polish immigrant parent population. However, it was difficult to identify alternative ways to gain a range of views.

The use of these online surveys also allowed for a snowball approach (Cohen et al., 2000), with participants being asked to share the link with other parents living in Sweden or Norway. However, as the participants were most likely to recruit friends, this approach was also subject to bias. Nevertheless, it provided an opportunity to gain more participants from the target group with experience of ECEC.

In Article I, I indicate the respondents' gender and years of residence in Sweden. Figures 1 and 2 present this demographic data.

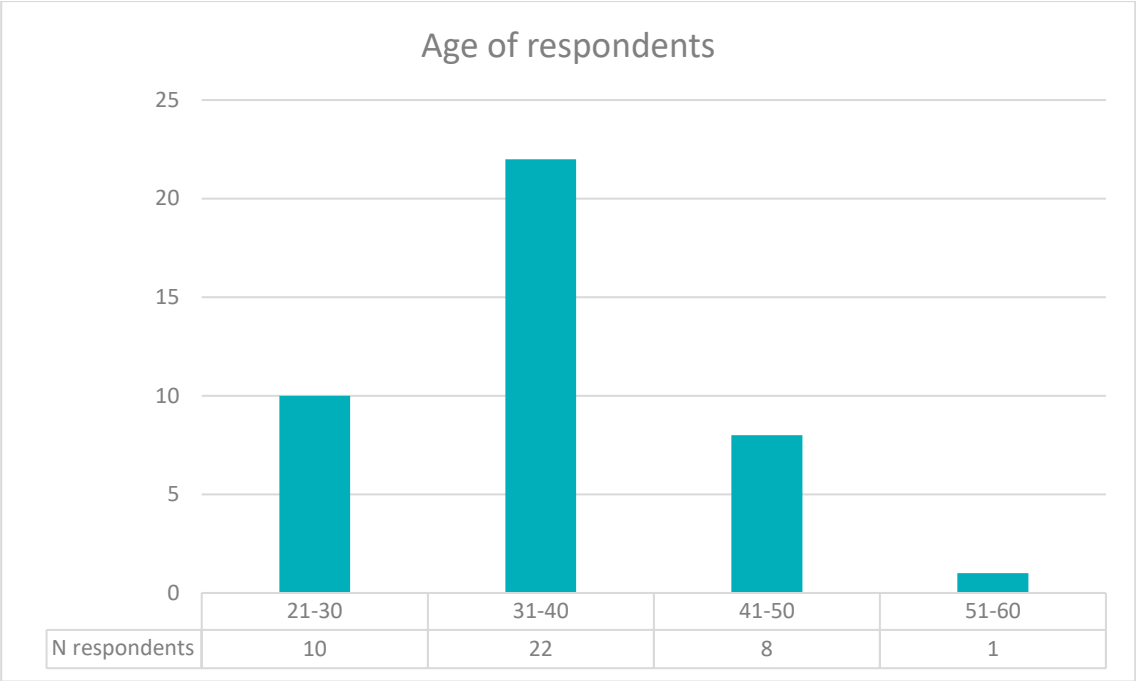


Figure 1: Age of respondents

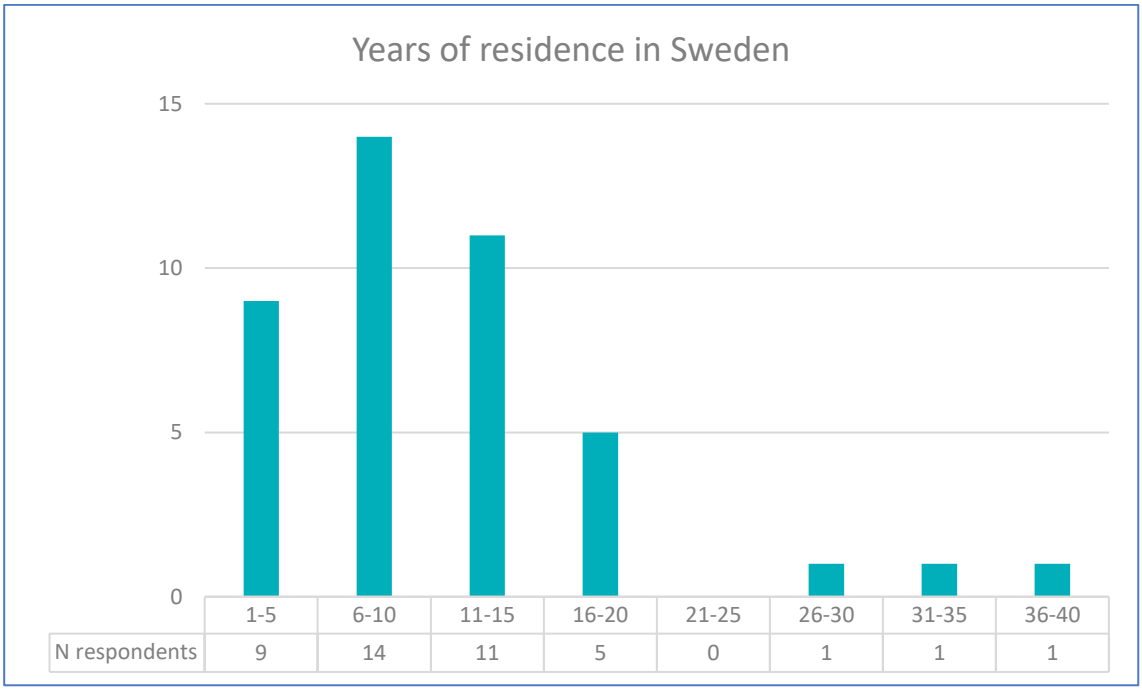


Figure 2: Years of residence in Sweden

The majority of the participants in the 21-to-40 age group, which is not surprising given that the survey was about parents' experience of young children. Figure 2 shows that many of the participants had lived in Sweden for less than ten years (23

of 41). 39 of 41 participants had children attending *förskola* in Sweden (the other two parents had experience only of Poland), suggesting that the participants' views had been shaped recently and in Sweden.

The responses in the online survey were mainly in Polish, with a few in Swedish. The data was transferred into a Word document and translated into English.

4.4. Photo-elicitation focus group interview (PEI)

In this section, I describe and justify my decisions on the use of focus group interviews based on photos that the participants themselves had taken (PEIs). At the end of this section, I reflect on the researcher's position as a facilitator of PEIs (section 4.4.2.) in respect of the need to be transparent about my methodological choices.

Photo elicitation is a method that involves participants taking photos that are later used as stimuli during interviews. Using their own photos helps participants to articulate their own interpretation (Hurworth, 2004) and thus provide insights into how they see the relationship between individual views and the wider societal context. The participants' choice of photos is an initial consideration when investigating specific groups' views on certain experiences from particular environments. Photos as stimuli provide familiarity. Harper (2002) stated that it is assumed that when a person takes a photo, they have specific reason which is meaningful to them and this meaning can be uncovered in the interviews. One of the purposes of using PEIs and adopting a visual method was to offer participants a different form of expression, as they were in control of what was captured in the photograph. The photos, therefore, allowed the participants to influence the direction of the interview and thus offer their personal views on particular issues (Greenbaum, 1999; Harper, 2002). In discussing PEIs, Harper (2002) referred to "reflexive photography" or "autodriven photo elicitation" as a form of co-production by the researcher and the research participants.

Photos as visual data (Miller, 2015), interviews in which participants discuss and reflect on photos (Hurworth, 2004; Torre & Murphy, 2015) and photo-elicitation (Epstein, Stevens, McKeever, & Baruchel, 2006; Miller, 2016) have all been used in

early childhood studies to discover participants' views on particular issues. Discussing different events in mathematics activities allowed the participants to reflect on their own ideas as well as on those of others (e.g. Harper, 1998). For example, in their research into early childhood mathematics education, Clarke and Robbins (2004) gave a camera to parents to document their children's experiences at home and in their neighbourhood. ECEC teachers were also invited to share their own photos to discuss young children's mathematics activities.

PEIs have been used in earlier mathematics education research as well. For example, researchers have used teacher educators' own photos to elicit narratives about their children's engagement in mathematical activities in interviews about mathematics education at home (Hauge et al., 2018). Hauge et al. (2018) stated that the photos triggered discussions, memories and meanings, as they helped the teacher educators to reflect on their experience. In earlier research (Lembrér, Kacerja, & Meaney, 2018), my colleagues and I investigated early childhood pre-service teachers' awareness of young children's engagement in mathematical activities by asking them to complete a survey on what they noticed in a photo and what they would suggest the children be encouraged to do next. We found that the inclusion of the photo allowed us to gain insights into the pre-service teachers' pedagogical mathematical knowledge, including their understanding of the mathematics they saw in the photo. However, we also noted that the pre-service teachers' deep reflections were limited, perhaps because they needed to provide written responses. We suggested that interviews about the photo might have elicited more profound reflections.

The earlier studies indicated that PEIs offered opportunities for collaboration because photos have communicative features which, when viewed together, required the sharing of attention (Lapenta, 2011). In my study, asking participants to take photos gave them the opportunity to decide what constituted mathematics for young children. It also gave them the opportunity to illustrate their own experiences, which could be discussed in interactions in PEIs. Participants responded positively to taking photos and produced many photos capturing different activities that they

considered illustrative of young children engaging with mathematical ideas. The data collection began in May 2017 and ended in November 2017.

I chose to obtain the parents' views through focus group interviews based on their photos in order to acquire information about a topic and to understand its complexity (Kvale & Brinkmann, 2009). Powell and Single (1996) defined focus group interviews as "a group of individuals selected and assembled by researchers to discuss and comment on, from personal experience, the topic that is the subject of the research" (p. 499). I also obtained teachers' views, because Wager and Whyte (2013) showed that ECEC teachers often dismiss parents' views if they are too distant from the teachers' own experience. It was therefore important to see how interactions between parents and teachers affected what could be valued as mathematics education for young children within each PEI.

The *barnehage* that agreed to participate had parents with a multilingual background. An initial invitation to participate in the project was sent to teachers and parents through the head of staff (Appendix 3, Appendix 4). However, as noted previously, no parents with an immigrant background agreed to participate.

By having parents agree to participate in the project, I assumed that they would have views on their children's engagement in mathematics activities at home. Nevertheless, their background, including their professions, was unlikely to be the same, suggesting that they would have a range of views. In contrast, the teachers were assumed to have similar experiences as professionals working at a *barnehage*.

In this project, parents were asked to capture what they considered to be mathematics activities. Participants were asked to take up to 10 photos of children engaging in mathematics activities in their environments (home and *barnehage*). The data collection may have influenced the parents' behaviour in that the camera could capture only certain activities and not, for example, discussions or other abstract happenings. In addition, the task of taking photos at home may have influenced the social interactions at home.

The focus group interviews provided an opportunity for the participants to share their ideas and experiences. In Articles II, III and IV, the data came from transcripts

of the focus group interviews based on the parents' and teachers' photos. As noted in Table 1, PEIs were conducted with nine parents and eleven teachers, in both homogenous and heterogeneous groups.

4.4.1. Selection of photos for PEIs

Birkeland (2013) noted that researchers need to pay attention to how photos are chosen for PEIs. To gain a wide range of views on a certain topic or subject, a balance is needed in the amount of time that each participant has to talk (Morgan, 1996). The use of photos provided a structure for the interview so that it is the participants who talk the most and not the researcher. As stated by Hurworth (2004), in selecting photos for PEIs, researchers should aim for as little discussion about specific aspects of the photos as possible. This is because the photos are to act as stimuli for the interview rather than being its sole focus.

To keep the time spent on the focus group interviews reasonable, I selected only some of the photos for the PEIs. In making these choices, I focused on the photos that were mostly likely to provide the participants with opportunities to influence the interview by describing memories. At least one photo from each participant was chosen for the interview.

From the nine parents and eleven teachers, I received 160 photos: 73 from parents and 87 from teachers. The photos showed familiar outdoor places, materials and television programmes. In the interviews, the parents often reported having taken their photos at the end of the period specified for data collection.

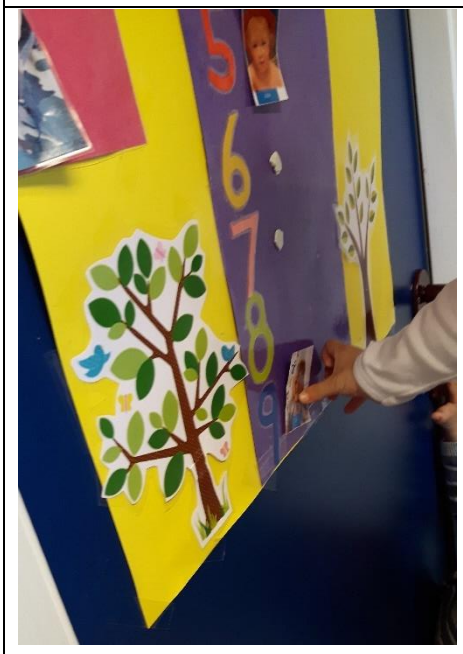
In selecting the photos, I was guided by Bishop's (1988) six mathematical activities (playing, explaining, designing, locating, measuring and counting). This classification had proven useful in research by Hauge et al. (2018) and was consistent with the background to the mathematical goals for Norwegian *barnehage* (Solem, Reikerås, & Tronshart, 2017). As noted in Chapter 1, Bishop's (1988) six mathematical activities provided a broader view of mathematics than the view of school mathematics (Helenius et al., 2016). It was anticipated that the classification would provide a wide representation of mathematics situations so that different views could be discussed.

Bishop (1988) described the six mathematical activities as universal for any culture. These activities are:

- Counting. The use of a systematic way to compare and order discrete phenomena. It may involve tallying, or using objects or strings to record, or special number words or names.
- Locating. Exploring one's spatial environment and conceptualising and symbolising that environment, with models, diagrams, drawings, words or other means.
- Measuring. Quantifying qualities for the purposes of comparison and ordering, using objects or tokens as measuring devices with associated units or 'measure-words'.
- Designing. Creating a shape or design for an object or for any part of one's spatial environment. This may involve making the object, as a 'mental template', or symbolising it in some conventionalised way.
- Playing. Devising, and engaging in, games and pastimes, with more or less formalised rules that all players must abide by.
- Explaining. Finding ways to account for the existence of phenomena, be they religious, animistic or scientific (adapted from Bishop, 1988, p. 182).

Initially I classified all the photos into one or more of Bishop's (1988) six activities, with some photos classified according to more than one activity. Although I was aware that the participants might not agree with my classification, what was important was how the photographs were seen by the participants during the interview. As a way of choosing a wide array of photographs showing different aspects of mathematics, Bishop' activities helped me to reflect on the kinds of discussions that the photos were likely to elicit. Table 3 provides examples of the classification of the photos using Bishop's six categories of mathematical activities.

Table 3: Examples of photos and classifications

Photo	**Classification using Bishop's definitions of mathematical activities**
	A photo of two children in a swimming pool, perhaps having a swimming lesson. This was classified as "Locating" (Bishop, 1988), because these children might be exploring spatial and body orientations in this environment. The children might also be determining how large the swimming pool was in relation to their own bodies. Thus, I classified this photo as representing "Measuring" as well.
	A photo of an information board on the wall of a hallway at a *barnehage*. Children, parents and staff use this board to sign children in and out of the *barnehage*. In the photo, a child is holding a photo of himself up to the board. In this activity, the child might be using one-to-one correspondence by holding the photo next to a number symbol. Therefore, I classified this photo as "Counting".

	A photo of two children in a sandpit. I felt that this activity involved measuring the volume of the plastic containers and so classified this photo as “Measuring”.

Once I had classified the photos according to Bishop’s six activities, I selected two to three photos from each participant’s sets of photos. This was to ensure that each of the participants had the opportunity to take the lead in the PEI by talking about their own photos. Pictures are considered good at “showing” but they are not very good at “telling” (Baetens, 2009, p. 143), so it was important to ensure that the participants were encouraged to talk about their experience. Seven of the 20 participants provided three to seven photos, making the choices somewhat easier. However, 12 participants provided between 8 and 15 photos, with one participant sending 17 photos.

When selecting the photos, I also considered technical issues that might limit the participants’ ability to interpret them, such as sharpness or light.

4.4.2. Conducting focus group interviews and the researcher’s role

In this section, I describe the procedure for conducting the PEIs and justify the number of participants in each interview.

The focus group interviews were held at the *barnehage* in June 2017 and November 2017. After discussion with the head of staff at the *barnehage*, the interview times were set for the afternoons, so that the participants could have their children at the *barnehage* while they took part in the discussions.

As noted earlier, I had two groups of participants: parents and teachers. Therefore, I created three sets of photos. The first set included photos taken by parents and the second set by teachers. For the PEIs with both parents and teachers, I created a third set based on the earlier selections for the first and second sets. For the joint PEIs, I

chose one photo from each participant because of the reduced number of participants and the times for the interviews. I also chose photos that showed children engaged in activities that I felt might have occurred at home and at the *barnehage*.

For the PEIs, all of the participants were able to choose the date and time that suited them best. In accordance with Morgan (1996) suggestion that a reasonable group size is four to eight persons, I aimed for groups of four to six participants. The first set of PEIs, with the parents, consisted of two groups of five and four participants respectively. The second set, with the teachers, consisted of two groups of six and five participants. The third set of PEIs, with both parents and teachers, consisted of three groups with three, five and five participants.

Figure 3 presents the number of participants in the PEIs conducted in June and November 2017. To anonymise the participants, they were each allocated a code made up of a letter and a number. P stands for "parents 1- 9", while T stands for "teachers 1-11". As the gender of the participants was not regarded as a factor of interest, no distinction was made in the code. The symbols "a" and "b" assigned to P6 indicate that these parents came from the same household and both reported taking photos. For the presentation of the transcripts in Article IV, I changed the codenames for practical reasons. T4 became T1, T2 remained T2, T7 became T3, P6a became P1 and P3 became P2. This order of code names was necessary to simplify the presentation of the data.

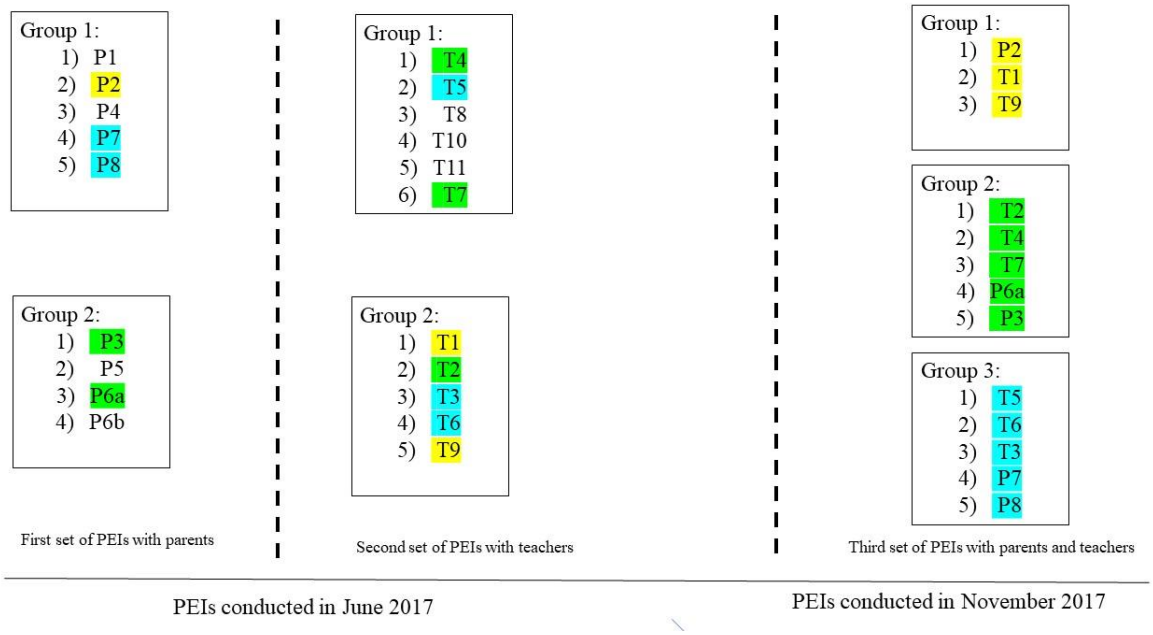


Figure 3: PEI groups and participants

The colour coding shows the distribution of parents and teachers in the third set. Participants without a colour code did not participate in the third set of PEIs. The time that elapsed between the first and second set of PEIs and the third may have contributed to the reduction in participants. However, the practicalities of conducting the research meant that it was not possible to have the third set of interviews any sooner.

The room in which the PEIs were conducted was furnished with a sofa and a rectangular coffee table. I always sat in the same spot, with the participants sitting around me. Figure 4 illustrates how the participants and I sat at the table for the discussions.

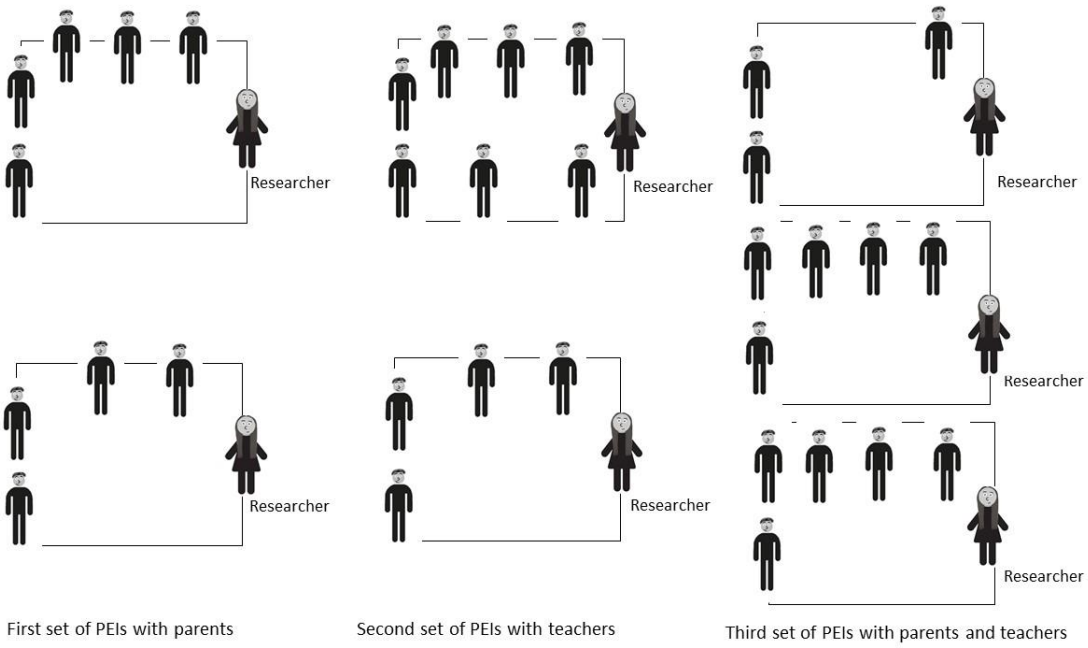


Figure 4: Illustration of seating arrangement during PEIs[5]

According to Gibbs (1997), it is the facilitator's responsibility to promote interaction between participants in a group interview, keep the discussion focused and ensure that everyone has a chance to speak. In each PEI, I asked the participants one at time to choose a photo and talk about what was happening in it. I used the same set of questions as a starting point: (1) Can you tell the story behind this photo? (2) What kinds of mathematics do you see children doing in this photo?

When the participants were not able to remember what had happened in the photo, the conversation was limited. At times, especially during the third set of focus-group interviews, some of the participants apologised for their photos or seemed to lack confidence when showing them.

I used audio and video devices to record the PEIs. The audio recorder was placed on the table and the video camera in the corner of the room to capture all of the participants. To manage the group discussion, I noted the participants' positions and used the video recordings to check speaker's identities when transcribing the

[5] Figures of participants are drawn by Hanna Lembrér in a digital app

audio recording. According to Morgan (1996), the quality of data captured by video recording in focus group interviews is often overestimated. Consequently, the primary source for the data transcriptions was the audio recordings.

Although I had previous experience as a facilitator of group discussion when working with professional development courses for ECEC teachers, the role of facilitator of the PEIs was challenging. My chosen facilitation style was actively listening and encouraging open discussion between the participants. At the time, I was a relative newcomer to the Norwegian context. It was a challenge to actively listen so that I could fully grasp and determine the meaning of what the participants were saying in order to summarise at appropriate times.

4.5. Analysis of the data

In this section, I briefly describe the analysis of the data, particularly the different analytical tools and their connection to narrative construction (Bruner, 1991, 2004) and the project's research questions. It is divided into three sections according to Elo and Kyngäs (2008) phases for data analysis: preparing, organising and reporting. The preparation phase involved the decisions about transcribing the audio recordings. Organising related to how to interpret the narratives in the survey responses and PEIs in order to answer the research questions. Reporting related to the decisions taken on presenting the results to different audiences.

4.5.1. Preparation phase

The preparation phase for the online surveys and the PEIs differed because of the kinds of data they generated. The responses from the online survey were downloaded from SurveyPlanet as Excel files.

The audio recordings from the PEIs were in Norwegian and were transcribed as part of the preparation phase. The process of transcribing verbal language into text is challenging:

> *Transcribing involves translating from an oral language, with its own set of rules, to a written language with another set of rules. Transcripts are not copies or representations of some original reality, they are interpretative constructions that are useful tools for given purposes (Kvale, 1996, pp. 166-167).*

For Kvale (1996), to transcribe means to transform, to change from one form to another. Consequently, the researcher needs to consider how to do the transcriptions as part of the interpretative process. As a Swedish speaker, I decided to have the audio recordings transcribed by a professional. I then checked the transcript by listening to the audio recordings. If necessary, I used the video recordings to identify the speaker. Although I was not looking for individual views on mathematics education, I found it important to track each parent, particularly in the joint parent and teacher PEIs, because of the complexity of their negotiations as shown in Article IV. I also inserted the appropriate photos into the transcripts.

4.5.2. Organising phase

The second phase of the analysis focused on organising the data analysis. I used different analytical tools to identify the parents' views on the basis of the narratives they told. As noted in Chapter 3, in order for the aims of Article I to be achieved, the first analysis related to societal norms and values. Article II focused on Bourdieu's (1975) field. A version of the narrative approach to the learning of mathematics was used for Article III. In Article IV, Foucault's view of power and knowledge and Bruner's narrative construction were used.

In this phase, the multiple-choice answers to questions 11 and 12 in the survey were compared to determine whether the parents thought that the mathematics activities the children did at home were different to what they thought they did at *förskola* (see Article I).

As described in Article I, the responses to the open-ended questions were examined together to identify whether and how the parents referred to their experience of mathematics education for their children at home and mathematics education as recognised in ECEC in Sweden and in Poland. I use the following example to illustrate the analysis of a parental narrative.

> P7: Every child is very hungry for knowledge and absorbs the new knowledge quite quickly. I am convinced that **play** is a good way to go. Contact with other children and the environment also **plays** an important role.

This response came from the survey questions in Part 2 (see Table 2) in respect of the parents' experience of Swedish *förskola*. The response was classified together with other responses that mentioned play. As play is highlighted in the Swedish curriculum as a basis for learning at *förskola* (Swedish National Agency of Education, 2018), this narrative seemed consistent with the curriculum, suggesting that P7 had been socialised into the Swedish understanding of how young children learn.

For Article II, the transcripts for the PEIs with the parents (First set of PEIs as presented in Figure 3, section 4.4.2) were examined to identify the advantages and disadvantages of using photo-elicitation interviews as a method for gathering data. The interactions were categorised according to the rules of the field, the parents' habitus and the parents' social or cultural capital. The rules related to how I, as the facilitator, organised the social situation to discuss mathematics education for young children using photos as stimuli. The social and cultural capital was considered to be the resources the parents could draw upon within the PEIs. Habitus related to the set of dispositions (behaviour) and the parents' sense of their place in the social situation and what they were expected to say or do.

It was therefore possible that the established rules of the field might interfere with or enhance relationships in the social situation. The following example (also presented in Article II) illustrates how the context of the PEI affected the opportunity to gain insight into the parents' views on mathematics education for young children.

Researcher:	Is Yahtzee a game that you play a lot in Norway?
P1:	It is a (holiday) cottage phenomenon.
P2:	Yes, yes, yes!
Researcher:	Okay.
P1:	Yes, everybody plays Yahtzee.
P2:	All Norwegians that have respect for themselves have Yahtzee in their (holiday) cottages.
Researcher:	So, you can claim that all children know Yahtzee in Norway?

P2: Yes, I think so. They probably have it in preschool too.

Researcher: But I mean, do you have it at home?

P2: Yes, it's quite common to have it at home.

P3: Yes, it's a regular game to have a home. Yes!

My follow-up questions as the facilitator of the PEI pushed the conversation in a particular direction, which altered the rules of the field. The rules of the field were considered to be dynamic and adjusted by circumstances, but the intention was that the interview be directed by the participants' interests. In this interaction, the social positions relating to knowledge about playing Yahtzee and the dispositions that the parents brought into the interaction with other parents and myself as the researcher were identified. These informed the relationship between the parents' experiences and what mathematics education for children was considered to be valuable.

In Article III, I focused on the parents' views on mathematics for young children at home. The analysis was carried out using a version of the narrative approach (Burton, 1996, 1999) to identify how parents saw their children's authoring, sense-making, collaborating and use of non-verbal communication. The adapted version of the analytical tool provided information about what the parents considered mathematics for young children to be. I used the following definitions when analysing the transcripts:

- Authority relates to an action and was identified when a parent described what children were doing in a photo. The narratives were based on children's behaviour, for example when watching a TV programme. The parents stated that the child was counting, as the TV programme was about "today's number is four".
- Sense-making was a personal narrative in which a parent described and classified children's activities according to why the children were doing what they were doing. For example, several times one child removed toilet paper rolls from a holder and put them back. While doing this, the child was pointing at each roll and counting: "One, two, one, two." The parent assumed that the child was very interested in counting, which was why they repeated what they were doing over a long period of time.

- Typical examples of collaboration appeared in the narratives about games, both games on digital devices and board games (such as Yahtzee or the Pokémon app).
- Non-verbal narratives related to how the parents interpreted their children's actions, such as when they used an artefact to convey meaning.

In Article IV, in relation to how the parents and teachers interacted in respect of mathematics for young children, the data analysis was completed in two stages. I used Bruner's narrative construction and Foucault's (1980a) view of power and knowledge to identify how the parents and teachers in the interactions emphasised certain types of knowledge, which provided insights into how some knowledge comes to be valued. Initially, I read through the entire set of transcripts and found that both parents and teachers expressed views on what I classified as: 1) pedagogical practices, 2) negotiation of roles and responsibilities for children's learning and development and 3) and mathematical skills, knowledge or content. In Table 4, I present examples according to this classification.

Table 4: Classification of data from PEIs between parents and teachers

Groups/Transcript	**Clarification**
1) Pedagogical practices	
T2 – It is very much these toys [sand moulds] that we have in the sandpit, such as buckets, shovels. These toys invite children to a range of play activities, right?	This was categorised as pedagogical practice in that T2 suggested that using particular toys in the sandpit prompted children to engage in play activities.
P8 – Yes, it's completely spontaneous [reading a book]. Children don't have very many thoughts behind it. They [the children] find a book and we read it. Many of the books that we have bought are because children can learn something from	P8 told a narrative about reading books with children. P8's description included a justification for them [parents] using books for different purposes and so was classified as a pedagogical practice.

them. But there are also some books from which they do not learn.	
2) Negotiation of roles and responsibilities for children's learning and development	
T1 – There is a lot of meaning behind playing shop. We have ideas for it, it is not just an activity but involving children in role play and participation.	T1 used their professional knowledge to describe how playing shop could contribute in specific ways to children's development. This narrative was thus categorised as being about the teacher' role in children's development.
P2 – Yes, many opportunities. But in everyday life, there is another consideration. That is that we cannot give them a NOK 10 coin to buy ice cream or something. You cannot buy ice cream for NOK 10.	This parent's response to the previous comment about playing shop related to how parents focused their interactions with children on everyday life, including shopping experiences. This required that they bring up the reality of how much ice cream costs.
3) Mathematical skills, knowledge or content	
P6 – Units with litres and decilitres. There is a lot you can address in mathematics, right. We also had a photo about cooking, so it is about the same. A lot of mathematical content is about the measurement of things.	In their narrative, P6 described measuring as the mathematics focus when children engaged in activities in the sandpit or cooking at home. As such, it was classified as being about mathematical content.
T6 – When playing Yahtzee, we add five and six or four and four. We also played with three dice, and children should then add using three dice. They learnt so fast and could count faster than me.	Although T6 described the pedagogical practice of playing dice games at *barnehage*, the focus was on addition and so it was classified as being about mathematics.

The participants' views were also identified through their use of personal pronouns: the first person – I and we; second person – you; or third person – he, she, it, they. For example, when a parent talked about themselves as a parent, they almost always used "I" or "me" (P3 – **I** think that it may be a good idea). On the other hand, the teachers tended to include themselves within a professional group and the children in another kind of group when narrating their experiences:

T2: Symbols, true. Symbols, triangles and squares. **We** see in **their** play that **they** are sorting things by colours.

T2 refers to mathematical content that may be present in children's play in *barnehage*: "symbols, triangles and squares". As such, this utterance was classified as relating to mathematics. T2 also made references to children by providing examples of them sorting things by colour. Simultaneously, T2 emphasised play as a pedagogical practice in that the children sorted while they played. When using the personal pronoun "we", T2 referred to the group of teachers as a cohesive whole with similar views. The children were referred to as "their" and "they". By emphasising the importance of the teachers' observation of children's play, T2 emphasised the role of the teacher as responsible for documenting children's development.

Foucault's understandings of power and knowledge were then used to identify whether and how specific views came to be valued. For example, in one of the PEIs, the parents and teachers began by discussing a photo of children playing with puppets from the story "Goldilocks and the Three Bears" in *barnehage*. The teachers then said that they counted with children.

P8: In fact, I have never thought about how many terms and how much mathematics are present in that story ["Goldilocks and the Three Bears"].

P2: I think that maybe ordinary things are used, that is, what one can use at any time during the day to practise counting.

T1: There was probably a child who started counting, so I connected to it and began counting.

P2: Yes, I kept saying that, in general, you can take it [engage in counting with children] in any situation.

In this excerpt, the teachers and parents discussed using everyday experience to get children to engage with counting as a pedagogical practice. P8 shared how they were

unaware of the potential of using play activities for practising mathematics. P2 shared their view on the value of everyday life experience in engaging children in counting. In this interaction, T1 responded to P2 by discussing how in the photo she saw an opportunity to continue a child's counting, indicating that she agreed with P2 that this was a valuable mathematical activity for children. Although T1 and P2 may individually already have valued the children practising counting skills in everyday activities, the discussion enabled this valuing to be shared rather than remaining an individual point of view. T2 emphasises the value of the knowledge teachers have from observing children playing at *barnehage*. T2 built on P8 and P2's descriptions and, in this way, exercised power by using their knowledge of pedagogical practices. P2 reinforced their having appropriate knowledge by providing narratives about using everyday activities that contribute to practising counting, suggesting that this knowledge acted as a truth statement in a Foucauldian sense.

4.5.3. Reporting phase

The final phase related to the decisions on reporting the results. As a researcher, it was important for me to learn how to write different kinds of research articles. Thus, I made decisions on reporting the results to ensure that a variety of formats were used. Article I has been published in a journal and Article IV will be published in a journal, Article II is a conference paper and Article III is a book chapter.

Each format has its strengths and challenges as regards word length requirements and expectations of what should be included. This affected the potential inclusion of the original Norwegian transcripts. In Articles I, II and III, the participants' words are reported in English only, meaning that the parents' narratives in their original languages were omitted so as not to exceed the word limits of the various publications. This has implications, as nuances of the parents' speech in their native language are lost. In Article IV, I included the Norwegian transcripts, focusing on the interactions between parents and teachers to show how, for example, the parents could disrupt the teachers' presentation of their knowledge, which led to different interactions. This article has been submitted to a journal that considers the inclusion of the original language important for maintaining the nuances of the speakers' languages.

In Article IV, I analysed an interaction in a PEI with two parents and three teachers (Group 2, illustrated in Figure 3). In many ways it was typical of the kinds of negotiations that the parents and teachers engaged in during the PEIs. Further articles will be written on other examples of the data, such as that included in section 4.5.2.

As well as producing academic articles, I have reported some results and, once Covid restrictions are eased, plan to report more results to the participants in the project. This plan has been developed in collaboration with the staff at the *barnehage* and the parents who participated in the PEIs. The results in Article III were presented to the teachers at the *barnehage* in March 2019. At this meeting, the head of staff and I discussed the possibility of meeting with parents and presenting the findings from Article III and, later, from Article IV. We decided to attend a parent conference at the *barnehage*. At the time, Article IV was in the early stages of being written. The best time to present both studies therefore would have been during the spring of 2020. Unfortunately, the spring of 2020 witnessed the global Covid-19 pandemic and limitations on travel and holding meetings. The meeting with parents on the project results will be rescheduled.

The reporting phase has also included decisions on how to label the participants. This, however, was discussed in the previous section, and ethical issues will be discussed in the next section.

4.6. Ethical considerations

Formally, this project has been approved by the Norwegian Centre for Research Data (NSD) (approval numbers 51400 and 53595 – see Appendix 1). As such, its ethical considerations are informed by Norwegian data laws as they were at the time of the data collection. Significant elements of the NSD requirements were included in the consent letters to the participants, as they discuss confidentiality and data handling. The introductory page of the survey (see Appendix 2) and consent letters are referred to in Appendices 3 and 4. To ensure the confidentiality of the participants, I have not included any descriptive information about the *barnehage* where the PEIs were conducted. Information was provided to the participants about the project's end date, at which point the data was anonymised. The NSD was

notified of this in March 2019. For the PEIs, as the parents and teachers had taken photos of the children, ethical considerations included ensuring that the parents gave approval on behalf of their children.

NSD principles guided the collection and storage of data and the need for participants to be treated with respect. The Norwegian National Research Ethics Committee (NESH, 2019) focuses on such fundamental principles as respect, good quality outcomes, fairness and integrity in its general guidelines for ethical considerations in research. The Norwegian National Research Ethics Committee emphasises that in qualitative research, participants have the right to information, consent, confidentiality, and assurance that the data can be used only for the study.

The responses to the Swedish online survey came in an anonymised format. At the time, this meant that ethics approval was not required in order for it to be conducted. Following a change in privacy laws, the survey of Polish parents in Norway did receive NSD approval and the data was anonymised by deleting IP addresses (approval number 53595).

To ensure confidentiality, the storage of the data followed the ethical guidelines of the NSD and the university's guidelines and procedures. Audio and video materials were stored on a password-protected server at HVL. These were available only to myself and my supervisors. It was also noted on the consent form that several researchers in the research group had access to the data material.

The ethical considerations for the PEIs are the same as for any other method of qualitative research apart from the participants not being fully anonymous to each other as they met each other and shared their views (Gibbs, 1997; Morgan, 1996). Consequently, at the beginning of the PEIs, I indicated that what was said in the group should stay in the group. In addition to the information given at the beginning of each PEI, I maintained dialogue with the participants in respect of the reasons for the audio and video recording. I consciously tried to ensure that the participants had the opportunity to provide ongoing consent for their participation.

The researcher's role is also an important ethical consideration. It was important to consider how my position might affect access (trust, openness), decision-making

and people's lives and the realities presented in the results of the project (Fossheim & Ingierd, 2015). My role has also included a responsibility to monitor how the findings were interpreted and that procedures were followed as described in the information letter on the project's aim and objectives. As a researcher, my role in the PEIs was not impartial as I facilitated them. Thus, I interacted with the participants and asked them questions. In conducting this research project, I have acted in accordance with the ethical principle of beneficence, which addresses the researcher's obligation to act in a way that benefits ethical research practice (Guillemin & Gillam, 2004).

4.7. Chapter summary

In this chapter, I have described and justified the data collection methods, the research design, the three phases of data analysis and the ethical considerations. The research paradigm as a background to online survey and photo-elicitation focus group interviews posits that knowledge is constructed and measured by its consequences and relevance to the context. The context, methodological choices and design for collecting data from the online survey and PEIs have been presented and addressed. The survey questions and selection of photos for PEIs have helped to explain the procedures in more detail. The analysis of the sub-studies of the thesis has been discussed along with its connection to the theoretical framework and research questions. Finally, ethical considerations related to the thesis have been considered in terms of consent, confidentiality and data handling.

5. Results and discussion

In the first section of this chapter, I present an overview of Articles I–IV and summarise the main findings from each of these sub-studies. I then discuss the findings from the thesis's overarching research questions. In sub-section 5.2, I describe the findings related to narrative construction (described in Chapter 3) as a response to the first research question: how can parents' views on mathematics activities for young children be identified? In sub-section 5.3, I present the findings for the second and third research question: what do parents' value in mathematics education for young children and what might influence their views?

5.1. Overview of the sub-studies

The original articles on which this thesis is based are presented in Chapter 9. Table 5 presents an overview and includes the title, research focus, theoretical perspective, methodology, analysis and findings of each article.

Table 5: Overview of articles: title, research focus, theoretical perspective, methodology, analysis and findings

Title of article	**Research focus**	**Theoretical perspective**	**Methodology and analysis**	**Findings**
Polish parents' views on mathematics activities at home and in Swedish preschools	To explore Polish immigrant parents' views and ideas about mathematics for young children in Swedish *förskola* and at home	**The theoretical lens of the socialisation process** into which members of society are acculturated as active, knowledgeable individuals while also being enculturated into the existing norms and values of society	**An online survey** was designed to gain insight into parents' views. The analysis focuses on Polish immigrant parents' norms and values and how these may relate to Polish or Swedish culture or to the merging of existing norms and values in new ways.	Polish immigrant parents indicated a similar set of activities that children engaged in at home and at Swedish *förskola*. They tended to align their justifications with the norms and values of the Swedish preschool curriculum. The findings suggest that they generally recreated values regarding how children learn from the Swedish *förskola*.
Using photo-elicitation in early years mathematics research	To examine photo-elicitation interviews as a methodology for gathering data about parents' views on mathematics	**Bourdieu's notion of the field** was used to discuss the advantages and disadvantages of using PEIs in the current project. The field was defined as a social arena in which participants in different relationships are bound by certain rules. The field was used to identify how parents' sharing of views was affected through narratives.	In reflecting on my **use of photo-elicitation focus group interviews**, the analysis identified both advantages and disadvantages associated with gaining an understanding of parents' views on mathematics for young children.	The established rules of the field both interfere with and enhance relationships between participants in the PEI. The PEI includes certain kinds of rules, such as the choice of photos to stimulate the discussion. This choice promoted dialogue and reflection while also limiting parents' participation if they were unable to recognise any mathematics in what the children were doing in the photo.

Parents' valuing of mathematics for young children	To explore how parents describe their children's engagement with mathematics at home	**A narrative approach to learning mathematics** was used to understand the meanings that parents imposed on mathematics learning when discussing children's activities at home.	**Photo-elicitation focus group interviews with parents**, where parents' photos were used as stimuli for interviews. Analysis used a narrative approach to identify the kinds of values parents attached to their children's mathematics learning in home situations.	Parents valued their children's learning of numbers, counting skills, early measuring concepts and use of money. Parents provided detailed justifications for the ways in which they supported their children's development of these skills.
Parents and teachers negotiating truth statements about mathematics education for young children	To identify how parents and teachers interact when sharing views on young children's mathematics education	**The Foucauldian terms power/knowledge** and **Bruner's narrative construction** are used to analyse and discuss the data. In the interactions, parents and teachers navigated between their experiences and values of mathematics education for young children.	**Photo-elicitation focus group interviews** (PEIs) were set up to provide opportunities for parents and teachers to share their views. The analysis was completed in two stages which identified: narratives that described events related to mathematics education and how participants negotiated which knowledge was offered, accepted and valued.	The way that power and knowledge circulated resulted in only some knowledge being valued. Teachers' knowledge of pedagogical practices tended to take precedence, but parents also negotiated the value of their views, which led to different kinds of interactions.

5.2. Elicitation of parents' views

In this section, I discuss how parents' views on mathematics education can be identified as a response to my first research question. In undertaking this project, I came to understand that the two types of narratives that appeared in the responses to the survey questions and in the interactions in PEI were produced as a result of the way the survey questions were asked and how the interactions between the participants in the focus group interviews developed. The contexts in which the narratives were produced gave me insight into why various aspects of individual and societal views appeared.

In Chapter 1, I defined parents' views as the ways in which things and events can be described from a certain situation or position. These views become evident in the narratives parents tell about their experiences with their children's mathematics education. As discussed in Chapter 3, Bruner (1990) states that the stories narrated by members of a society provide insights into the particularity of their lived experiences. As such, they give insight into their individual experiences against the backdrop of societal expectations as regards what can or should be described in the narratives.

The narratives come from two data sets in which parents reflect on their children's experiences of mathematics education (see Chapter 4). These two data sets are the responses to the survey questions and the discussions in the PEIs. The survey questions asked for individual parents' experiences related to the environments of home and ECEC in Poland and Sweden where their children might be involved in mathematics education. The questions were designed to elicit the telling of narratives. Although the survey required individual responses, it was assumed that there would be societal influences on the narratives through the parents' expectations about the kinds of answers that the survey developer was expecting. Similarly, the narratives told in the PEIs reflected the specific context of the PEIs, including the contributions of other participants and the impact of wider society on sharing individual memories of events within a group.

Thus, the narratives provided insight into the relationship between specific individual experiences and the wider societal context that affected those experiences

and what participants viewed as valid to share about mathematics education for young children. For example, within the individual responses to the online survey (presented in section 4.3), I could identify views on societal norms emphasising the particularity of mathematics education for young children at ECEC that would not be different from what they would do at home. The individual narratives from the survey were quite short, sometimes with few details and links to their lived experiences. Consequently, it was only from viewing the whole data set that the societal influence on these narratives became visible.

In the survey responses, the narratives showed links between mathematics education at home and ECEC in relation to mathematics content and pedagogical practices. For example, one parent said:

> A1 – P30: Children learn to count in play activities. I think that play is a good approach to learning mathematics.

> A1 – P41: I think parents should receive more information about the kinds of mathematics activities children engage in at *förskola*. Parents could then enhance these activities or do something similar with their children at home.

This narrative provided information about a specific personal view but can also be seen as connected to societal expectations adopted by the narrator of what pedagogical practices are and what the value is of children playing pretend as ways of engaging with mathematics. When a series of individual narratives present a similar view of what is valid mathematics education for young children, the societal impact on that view becomes more evident.

The survey questions also limited the kinds of narratives that the parents shared about their experiences of mathematics education for young children at home. Frequently, they responded to the questions about their home experiences by aligning their views on mathematics education for young children with those promoted in *förskola*. Therefore, the kinds of narratives collected through the survey led to the identification of particular kinds of views.

I also found that the kinds of narratives produced using the survey provided types of insights that may differ from those obtained by way of another methodology. The

questions about individual experiences were designed to encourage parents to describe mathematics education for young children. Nevertheless, the parents' experience of everyday life in the given society was influenced in some way by actions and events around them. What did emerge from using the survey was an implicit recognition of the conditions for views that could be identified. Therefore, the kinds of collected narratives provided an overview that could be used to explore parents' views on mathematics education for young children. I will discuss this finding more in the next section.

The co-constructed nature of the narratives was evident in the PEIs, as the parents drew upon input from others when they brought up various points. As such, the narratives can be seen as co-constructed, and the parents' interpretations of their own individual experiences were less apparent than were those of the group. As the interaction developed and the various narrators negotiated and came to accept ideas, a joint narrative about a set of experiences was produced. In the interactions, the parents were able to reconstruct, unpack and contextualise their views, which gave insight into what influenced those views beyond what had been evident in the survey responses. For example, as is shown in Article IV and Article III, the interaction led parents to reflect on the taken-for-granted use of digital tools or playing of board games at home.

In the PEIs, some of the participants reported that they had not discussed with teachers the kinds of ideas about mathematics education they might have to share. P8B said, "Teachers probably do it, but it may well happen. Probably does, but it's a little invisible to us, really. They probably do it, but not in our experience."

Asking the participants to photograph young children engaged in mathematics education gave them an opportunity to decide what mathematics education is. This was in contrast to the survey questions, where I had presented several examples of mathematics activities based on earlier research (e.g. Aubrey et al., 2003; Bottle, 1999) and asked them to choose those activities which they recognised their children engaging in at home or in ECEC.

These interactions produced narratives that can be considered to be less about individual views connected to events and more about collective/shared views on mathematics education for young children. The societal influence on the collective narratives was more evident as a result of the negotiation between the participants about what was valued as mathematics education for young children. For example, playing the board game Yahtzee was identified as a way of learning about numbers. Another example, buying things and spending money, was identified and valued as a way of learning the equivalence of money (Article III). The parents' views became apparent in how they described events and highlighted specific aspects of mathematics education for young children in their narratives.

However, the photos were used only as stimuli in the PEIs. As a researcher, I determined which of the photos provided by participants would be used to stimulate the conversations. The interaction process that accompanied the presentation of a photo revealed a complex interrelationship between what had been photographed and what the parents valued in their role as parents (which also applies to the PEIs with teachers). As a result, I also identified that the parents' views related to roles, kinds of engagement, and influences (discussed further in section 5.3).

In this section, I have discussed how it was possible to identify parents' views through the different kinds of narratives that arose in the responses to survey questions or in the focus group interviews. The narratives were affected by the various settings in which they were produced, thus providing insights into some of the parents' views on mathematics education for young children. It seems that the impact of co-construction in the production of narratives may have affected the narratives and, therefore, the parents' views that were identifiable within them. The views on mathematics education for young children were situated simultaneously within the individual experience and within the societal contexts and related to societal expectations in connection with the data collection methods. In the next section, I discuss what the parents' views on mathematics education for young children were and what may have influenced them holding these views.

5.3. Parents' views on mathematics education for young children

In this section, I discuss parents' views on what mathematics education is valued for young children and what might influence their views.

The results from the PEIs suggest that the parents highly valued the mathematical subject of counting, including aspects of equivalence. They also considered that everyday experiences provided useful contexts for introducing mathematical subjects such as counting. At home, they generally described their role as adapting and supporting their children's engagement with mathematics while taking into consideration their different developmental stages. In this section, I provide examples of narratives that emerged from the PEIs and the survey responses. As these examples came from both data sources, the survey data has "A1" as a prefix and the PEI data has the prefix "A2" (see Chapter 4, section 4.5.1). Examples that have been used in the articles are accompanied by references and page numbers.

As also occurred in the narratives in Hauge et al. (2018), the parents emphasised the value of learning counting but also brought up other mathematical subjects such as learning shapes. For example, in the survey questions, one parent described how their child talked about the shapes they worked with in activities at *förskola* (see for example, Lembrér, 2018, p. 195). In the PEIs, the parents discussed a range of measurement situations, such as the use of standard units, such as metres and centimetres, and clock faces. These examples were also noted in earlier research. For example, parent and child interactions related to learning how to tell the time were documented in Meaney (2011). In the PEIs, the parents of younger children described discussions about "having more" on a plate or in a cup.

Nevertheless, in a large proportion of the narratives counting was highly valued in everyday life situations. The parents described a range of different examples, including counting objects, sharing, determining how many and pairing. For example, in response to a survey question, parents provided narratives about their children's counting:

A1 – P39: The number of blocks, how many pieces of the puzzle, how much sand/water (different measures such as decilitre, litre). We count all the time in our everyday life, and this helps the children to understand mathematics.

A1 – P17: I do not think that playing in the sandbox has a greater impact on learning mathematics – unless they count sand moulds or distribute a group of toys in equal parts among the children.

The second example illustrates that, for some parents, mathematics education for young children was only about understanding numbers, particularly counting. Other aspects of mathematics, such as volume measurement or understanding shapes, which can occur when playing with sand, were not recognised and therefore not valued. Although these statements appeared in the survey responses, it was in the PEIs that it was possible to better understand the complexity connected to these narratives.

In the PEIs, the parents also described different aspects of counting that they paid attention to. Counting for very young children was often related to reciting the names of numbers and was often recognised as one of the earliest stages in learning to count. In some narratives, the parents described a rhythmic sequence, such as one, two, three and jump. At other times, the parents described children's ability to recite a sequence of numbers, occasionally illustrating non-standard counting as part of children's learning process: "1, 2, 4, 6, 7, 8, I think that's how he counts." These examples suggested that the parents valued the reciting of the names of numbers as an early component of counting.

Often, reciting the names of numbers was related to counting objects (toilet rolls, screws, stones etc.) (for examples see Article III, pp. 412–413). For example, parents described children touching each toilet roll, saying "1, 2, 3, 4, 6," or a child, keeping his finger on each car in a line and saying something, which, although not counting words, seemed to fulfil the same function as naming the objects in a sequence. Additionally, children were often presented as competent counters:

A1 – P5: My son is playing by counting objects. I wouldn't say that I am not a proud mother when I hear him counting on his fingers or counting various objects.

A1 – P18: My children were able to count at the end of *förskola* and able to solve simple tasks in the range of numbers up to ten.

P7: He is two years old. He's fairly good at counting, I think.

and

> *She has a book, and this book describes counting sequences 1, 2, 3. […] She would count the objects and match them with a numeral on the screen (Lembrér, 2020, p. 412).*

Learning to count, which the parents often identified as a necessary component of everyday activities, appeared in many of the narratives.

The parents also described more complex understandings of counting, such as when the name of the final number represented the total amount (the principle of cardinality):

> *He often asks, 'How many fingers is 4?' He likes to count. I ask him what else 4 is, can you find something that is 4 of? We count together when he gets the wrong number of items and needs to add or subtract 1." (Lembrér, 2020, p. 413).*

Narratives on this aspect of counting often occurred in the PEIs when the parents discussed playing games with their children. Mathematics education researchers have long promoted the use of board games for developing young children's understanding of number (see for example, Elofsson, Gustafson, Samuelsson, & Träff, 2016; Gasteiger & Moeller, 2021; Siegler & Ramani, 2009). However, the range of counting skills that the parents discussed were much more varied than what has been advocated for use in ECEC in this earlier research. The parents described playing games, as discussed in Article III, as providing many different opportunities for children to use counting skills. Yahtzee, for example, involved "gathering all the sixes", and "We count how many dots there are on the die." In these examples, the parents focused on encouraging children to count with them and recognising specific amounts through pattern shapes or from the numerals.

In the PEIs, the parents gave examples of playing board games, such as Ludo, which are played by two or more persons using one or two dice. LeFevre et al. (2010) and Sheri-Lynn et al. (2014) stress that when parents explain counting principles or point out number symbols, this contributes to children developing mathematics skills and understanding. The parents in the PEIs told narratives about playing

games in which each person, according to the children's counting skills, rolled a die, identified a number (or dots) on the top face and then counted out a corresponding number of steps/moves on the game board. Playing Ludo also provided many opportunities for children to add the numbers on two dice, which required recognising number patterns and symbols as well as engaging in addition.

In some of the narratives, the parents also highlighted equivalence as being a part of understanding numbers in connection with counting. Equivalence referred to whether items had the same value. This can be seen in narratives about one-to-one correspondence, such as when children placed one object in each hand. Other examples included exchanging money for ice cream. In one narrative, a parent described going to a recycling centre and how they talked with their child about the number of cans that needed to be recycled to gain an equivalent amount of money to buy a Lego set:

> *The aim of going to the recycling centre with my son is to talk about the value of things. I explain to him how many bags of cans we need to recycle in order to have money to buy a small Lego set. So instead of talking a lot about numbers, I compare the number of bags we need to recycle to save for Lego. I am not good at it, but I try to help him relate to it (Lembrér, 2020, p. 416).*

Although determining the number of bags to be recycled relates to counting, the focus was on equivalence in regard to buying Lego sets. In the narratives, the parents highlighted how everyday experiences provided meanings related to quantities and equivalence for young children.

Many of the examples described in the narratives came from everyday life, which seemed to be a pedagogical approach consciously adopted by the parents. As Aubrey et al. (2003) also find in their study, the parents incorporated early numeracy experiences in a variety of ways. The parents' narratives described the importance of children's interactions with their environments, particularly with their families. As discussed in Chapter 2, the role of parents and family members in children's early learning has been well documented (Melhuish et al., 2008). In the PEIs, it was clear that parents not only valued counting as an important form of mathematics for young children but also utilised the opportunities in everyday situations to support

different aspects of counting. The parents told narratives about counting connected to games and about recognising numbers on street signs, in stores, on tablets, during outdoor adventures or in other ways specific to their families.

They also noted that their children learnt to mimic counting words, including saying them in sequence while watching TV, or that their children knew the words to count to ten in English (perhaps from playing a digital app). Their children could recognise numerals on tablets, the TV remote control, book pages, car registration plates, phones and many other everyday objects.

The parents also described explaining to their children that they were waiting for 10 minutes or taking bus number 145 rather than another bus that came to the bus stop. In these activities, the parents focused on the contexts in which numerals appeared. Other experiences that were described included playing an outdoor game, where children could say "I won", and then look at the score together with their parents.

Another common pedagogical practice described by many of the parents was adapting how they engaged with the children depending on their age. Adapting the ways they engage with mathematics with their children is consistent with previous research (e.g. Blevins-Knabe et al., 2000; LeFevre et al., 2009). Some of the narratives included examples of using different kind of dice, reasoning and comparing each other's height using non-standard units of measurement with younger children.

Parents also described wanting their children to know how to use money but realising that this was a difficult concept for young children to grasp. Parents made pedagogical choices so that their children could experience exchanging coins and notes, such as fifty one kroner coins being equivalent to a fifty kroner note. This concern about age-appropriate experiences related to money has also been reported in earlier research. LeFevre et al. (2009) reports that money-related activities at home are frequent for children up to the second grade at school. However, in Skwarchuk (2009) study, which was restricted to children of preschool age, parents seldom reported activities that included using money or coins. Therefore, it may be

that the way parents adapted their children's home experiences of counting money is related to their views of what children are capable of doing at a young age.

In considering how mathematics education for young children is valued, the results suggest that parents' views are related to societal norms, their backgrounds and their engagement with children in home activities. These different influences combine in different ways in the different narratives.

The narratives about parents' use of everyday experiences as a basis for young children's mathematics education appeared to be in alignment with institutional policies of ECEC, in particular the Swedish preschool curriculum as shown in Article I. For example, playing with toys and engaging in games with other children at the preschool seemed to be highly valued as a way for young children to learn mathematics. This view resonated with what was written in the Swedish preschool curriculum about learning occurring through play (Swedish National Agency of Education, 2018). The societal norms and values as represented in the curriculum may have and then enacted in activities in *förskola* may have influenced how parents viewed mathematics education. In the PEIs, parents also described how their children brought home ideas from *barnehage*:

> A2 – P8B: I think that there is a strong connection between home and barnehage because children may get [mathematical] ideas in barnehage and can engage with it at home too and learn a little more about it.

This narrative indicates how P8B might have been influenced by what was done at *barnehage*, situating the work with children as being shared undertaking but where the parents would continue what had been done in the *barnehage*.

Parents may also have been influenced by hearing about others' experiences of their children, engaging in mathematics education at home. This may have influenced other parents to reflect on, for example, the societal norm of engaging with children in board games at home. In the PEIs, Yahtzee was raised as a general experience, which made at least one parent reflect on whether they participated in what was presented as a societal norm:

> *P3: I have got a little guilty conscience, because we almost never played Yahtzee with our other child. So we must go home and do that. (Lembrér, 2020, p. 409).*

P3's reflection of the lack of this kind of activity for their child made them consider that it was important to change their behaviour to become like the other parents. In the context of home, parents' views seemed to be influenced by societal expectations about using children's own interests as a starting point for introducing mathematical ideas as well as valuing their own roles in supporting their children to engage with mathematics education.

The data from PEIs showed how parents constructed activities which was the basis for children to develop their counting. The focus on counting may also have been related to societal expectations (see for example, Hauge et al., 2018) and parents' own background contributing to them recognising its importance in being able to operate in everyday life and for further schooling. Whereas mathematics education as discussed by ECEC teachers is about numbers and counting (e.g. Lee, 2010).

The parents' views on mathematics education also seem to have been influenced by their experience of their own schooling. For example, the parents said that they introduced addition to their children at home as it was part of what they needed in the future for school. Their views on the value of their children knowing addition seemed to lead them to consider how they could help their children develop mathematical ideas by engaging them in, for example, playing a game on a tablet. In the survey responses, one parent describes their children as learning mathematics in the same way that they had when they went to school. Another parent stated that mathematics education in ECEC should be aimed at later schooling:

A1 – P38: Mathematics in ECEC should be simple but prepare children for all the years they will spend learning mathematics at school and spark an interest [in this topic].

Thus, the parents' experience of school mathematics influencing their views on what young children should engage in was consistent with previous research, such as that by Takeuchi (2018).

Parents' roles also influenced parents' views on appropriate pedagogical practices for engaging in mathematics education with children at home. In supporting the children at home, the parents' roles focused on how to identify relevant everyday experiences and how to adapt activities to what they considered matched their children's developmental need. Thus the parents were not observers of the children, as the *barnehage* teachers described themselves (see Article IV), but individuals who interacted with their children.

5.4. Chapter summary

In this chapter, I have presented the results of the thesis's overarching research questions. I have identified how the narratives produced using two different methodologies for data collection provided different insights into the relationship between parents' individual views and the wider societal views on mathematics education for young children.

With regard to what parents' views are and what may have influenced them, the results illustrate some of the complexity associated with their views. Many parents emphasised that counting was important for young children and discussed what everyday experiences are appropriate for introducing young children to mathematical ideas; parents played a role in adapting activities so that children could engage with mathematical ideas. The influences on parents' views on mathematics education related to their roles and responsibilities in respect of children's mathematics learning and development. These influences came from both wider societal expectations and ECEC expectations, as well their own previous experience of mathematics education.

These findings related to parents' views suggest that an understanding of practices implemented at home could form the basis for collaboration with ECEC teachers. Although Sheldon and Epstein (2005) show that partnership between school and family encourages families to support children's mathematics learning at home, most intervention studies have focused on ECEC providing input into what parents should do at home rather than the other way around. Examples of this influence of ECEC on the home can be seen in the survey results. However, the narratives that the parents told about their experiences with their children provide a range of

opportunities for introducing mathematics education into ECEC that would be in alignment with curricula documents.

As I discuss in Article IV, however, such collaboration is challenging. The professional background of teachers may situate them as wanting to reinforce their professional knowledge by controlling what should happen in ECEC institutions. This can limit the potential for parents to contribute their experiences to discussions about collaborative planning of activities in ECEC. In the last chapter of this thesis, I will discuss the implications of the results of this project for recognition of parents' views on mathematics education in connection with collaboration between children's homes and their ECEC institutions.

6. Conclusions and implications

In the previous chapters, I have presented the project and its findings in respect of the overall research questions. As discussed in Chapter 2, there is a lack of studies investigating parents' views on mathematics education for young children. Much of the previous research has focused on researchers interpreting what they have seen in parents' interactions with their children or on how to "improve" parents' practices from the ECEC perspective.

My aim in this empirical project has been to develop knowledge about parents' views on mathematics education for young children. In responding to the three research questions in the previous chapter, I have provided insights into not only what parents' views are and what may influence them, but also how their views can be identified. While the link between practices in mathematics education in ECEC and home environments has been explored in earlier studies, the influence of the parents' understanding on teachers' views on mathematics education is rarely addressed. The results of this project systematically indicate both the mathematical topics and pedagogical practices that the parents valued for young children from their point of view. As Article III shows, the parents in this project had a broad set of understandings about mathematics education for young children that can be included in activities in ECEC. In Articles I and III, I argue on behalf of ECEC institutions incorporating parents' knowledge about children engaging in mathematics activities, while also acknowledging that ECEC pedagogical practices can influence how parents facilitate children's mathematics activities at home.

In Articles I and IV, parents' views on mathematics education for young children appear to be related to institutional pedagogical practices. Children's experiences at ECEC seem to be a resource that parents draw on, which reflects accepted societal norms (Article I). This is also represented in Article IV in, for example, appropriate pedagogical practices for young children at *barnehage*.

In Chapter 1, I have discussed how ECEC curricula, including those in Sweden and in Norway, require collaboration between teachers and parents on children's development. On the basis of this project, I realise that such collaboration can be

challenging. This is partly because of the complexity of their roles, which affects both their views and how they expect these views to be recognised within the collaboration. In conducting this project, I have identified only certain aspects of this complexity. If collaboration between ECEC staff and parents on mathematics education is to include what parents know, more research is needed. This will be discussed in section 6.4.

In the following sections, I discuss the implications for ECEC and other researchers of the use of Bruner's (1991, 2004, 2006) narrative construction as an overarching theoretical framework and methodological choice. I also discuss the implications for ECEC teacher education and suggest directions for future research arising from these insights. The final section provides concluding remarks.

6.1. Theoretical implications

An important reason for using Bruner's (1991, 2004, 2006) narrative construction was in order to identify parents' views on mathematics education for young children and the relationship between their views and wider society. To construct narratives, parents drew on many things, such as experiences from their everyday lives and memories, on the basis of which meanings are formed. When interpreting these narratives, there is the potential to see a broader story (Bruner, 2004) relating to how cultural and social context influences individual experiences as well as providing insights into shared norms and values. As Bruner (2004) highlighted, narrative construction is embedded in lived experiences in society and also acknowledges people's active and independent role within that society. Therefore, narrative construction shows the importance of contexts and provides opportunities for the exploration of views on particular topics, such as the needs of children and the family culture in which mathematics education occurs.

The aim of research using narrative construction is to emphasise the importance of participants' views in understanding a particular topic. In this project, my focus was on parents' narratives, as identified in survey responses and PEIs, which described different activities related to mathematics education that their children engaged in at home and ECEC. Parents' views on learning mathematics are situated in social interactions, while also being dependent on the parents' own experiences of children

engaging with mathematics at home. The narratives are therefore informative in terms of what the parents valued about mathematics activities at home.

In the PEIs, the narratives were produced in interactions with others on the basis of memories of events that linked the past to the present and indicated potential future mathematics education experiences for young children. One participant's narratives were often elaborated upon by others, who reminisced about similar events, places or settings during interactions in the PEIs (see, for example, the extended discussion in Article IV). However, as discussed in the previous chapter, when participants share their experiences, the group's valuing of certain kinds of knowledge may have a normalising effect on what is recognised as an appropriate view for an individual to have on mathematics education for young children.

The main theoretical finding was the adaptability of narrative construction, in that it provided an opportunity to integrate other theoretical frameworks in order to investigate specific aspects of parents' narratives. Although narrative construction emphasises the connection between individual views and societal norms and values, in this project I found that there was a need for more specific analytical tools to develop an in-depth insight into that relationship. The narratives themselves did not provide insight into parents' views. The insights came from combining narrative construction with other frameworks and analytical tools, as discussed in Chapter 4.

A variety of analytical tools were used to identify the reasoning and meanings behind the parents' narratives of their experience of mathematics education for young children. For example, as discussed in Article I, the relationships between parents' views and societal norms and values were identified by considering how the socialisation process affected individuals' interpretation of their experience and the complexity of societal influences through everyday interactions. In Article IV, Foucault's descriptions of the relationship between power and knowledge provided an opportunity to understand how parents' and teachers' negotiations within the narrative construction contributed to only certain types of knowledge about mathematics education for young children being valued by the whole group. In undertaking this project, alongside an awareness that views about mathematics education are not universal, it became clear that views can be disqualified by the

same rules, norms and methods by which experiences are constructed into narratives. Bruner's narrative construction (1991, 2004, 2006) was fundamental in synthesising the findings of the sub-studies so that a broader understanding could be developed of how individual and societal norms and values are related.

Parents are often positioned as the first educators of their children (Phillipson et al., 2017), yet little is known about what they consider valuable as educators of their children. Empirical evidence of parents' views on mathematics education is one way to fill in some of the gaps in early childhood research. The interpretations of their views can be expanded upon by applying different analytical tools in order to explore the relationships between parents' views and wider society.

6.2. Methodological implications and limitations

Being transparent about how the other theoretical frameworks relate to Bruner's framework (see Chapter 3) is important in justifying the various methodological choices. For example, the findings of sub-studies I to IV show how the contexts of the data that was analysed through the various tools affected their interpretation. In the previous chapter, I have discussed how survey questions and photo-elicitation focus group interviews can be designed to identify parents' views. Although these data collection methods are multifaceted, as discussed in Chapter 4 they also constrained to some degree the kinds of narratives that parents constructed (see Chapter 5, section 5.3).

The first research question addressed how to discover parents' views on mathematics education for young children. As discussed in Chapter 4, an advantage of using online surveys for data collection is that they are considered to be time-effective (e.g. Bryman, 2012; Cohen et al., 2000; Trost, 2012). However, collecting data from a specific group of immigrant parents in Sweden and Norway was complex. Using the existing online forum, which the target group utilised, required that I frequently repost the survey link to ensure that new visitors to the forum would see it and have the opportunity to participate. However, repeating the request to complete the survey can irritate participants and there is a risk that it will reduce the likelihood of participants recommending that others complete the survey. In

future, it may be necessary to use other approaches for reaching the target group in order to more easily collect the same amount of data.

As noted in Article I, the multiple-choice questions in the survey were based on mathematical activities engaged in at home which had been identified in earlier research such as Aubrey et al. (2003). However, the PEI data revealed other kinds of mathematics activities that young children engaged in at home. This suggests that a richer range of activities can be suggested if a similar survey is conducted in the future.

The project's biggest challenge was getting a sufficient number of parents with an immigrant background to both complete the surveys and become involved in the PEIs. Although there was eventually a sufficient number of survey respondents from both Sweden and Norway with a Polish background, finding ways to get in touch with large numbers of people in these groups proved difficult. In the second phase of the project, which was based on PEIs, the shortage of immigrant parents willing to participate resulted in a major shift in the project's aim. In future studies, it will be necessary to develop relationships with immigrant parents by joining networks and providing insights into the project in a set of sessions with parents prior to data collection. This will help to develop trust between the researcher and potential participants.

The process of collecting data through PEIs meant that the data changed as it was collected. In the PEIs, use of the participants' photos as stimuli for the interaction provided a basis for jointly constructed narratives that revealed similarities and differences in the participants' views. However, the interactions between the participants prompted discussions about mathematics education (Articles III and IV), which affected the parents' views. Birkeland (2013) stated that, in PEIs, telling stories about specific contexts includes participants confronting each other with different ideas. The parents also said that when they began to take photos, they became more aware of the mathematics activities that their children engaged in at home. Future research can focus on how and why parents develop their awareness so as to better understand how the data collection itself changes the outcomes of that collection. PEIs may also be viewed as interventions that have the potential to

develop collaboration between parents and teachers if more is understood about how collaborative interactions can be developed. In section, 6.4. I link PEIs to intervention studies as a suggestion for future research.

The PEIs helped the parents to jointly develop understandings of mathematics education for young children, both between themselves and with the teachers. This sharing can be considered both a strength and a limitation of the interactions in PEIs. By having participants discuss photos of young children engaging in mathematics, the PEIs helped them to provide justifications of their views. However, the time that elapsed between the participants taking the photos and the photos being discussed sometimes meant that the participants could not remember why they had taken a particular photograph. Therefore, the views expressed in the PEIs would change, both because of the time lag between taking the photos and discussing them and because of the influence of others when discussing them. In addition, outside of the PEIs, the parents may have expressed different views if they felt that some of their views would not be well received by the other participants.

6.3. Implications for ECEC

The findings of this study have implications for developing teachers' knowledge about how to discover and utilise parents' views on mathematics education in order to achieve the collaboration required in ECEC curricula. Studies have indicated that teacher education programmes should address – and provide pre-service teachers with a discussion of – what early mathematics should be taught to children and how (Benz, 2014; Parks & Wager, 2015; Whyte et al., 2018). However, as discussed by Parks and Wager (2015), there is a lack of understanding about the kinds of mathematics that children bring into ECEC institutions. In teacher education programmes, attention should be paid to parents as contributors of this knowledge as one aspect of achieving the collaboration referred to in the national documents.

In some of the articles, it was evident that parents and teachers had similar views. Such views can pave the way for discussions about children's development. For example, one Polish parent was inspired to collect stones as a play activity and then talk with their children about the stones' size or shape in a similar way to how it was done at ECEC. At other times, however, such as when discussing the use of digital

tools to introduce mathematical ideas to children (see Article IV), the parents and teachers had different views.

Nevertheless, in both cases, the teachers as professionals have a responsibility to find out from parents what they know and to initiate collaboration to make use of this knowledge. As a consequence, there is an obligation for teacher education to help teachers to develop ways of finding out what goes on at the home, such as by asking parents to take a photo and describe the mathematics they see in the photo. The complexity that accompanies interactions between parents and teachers means that without understanding how to find out what parents' views are, the collaboration between parents and teachers is likely to remain unidirectional, from ECEC to the home.

6.4. Future research

The findings from this project also indicate a need for further research into early childhood mathematics education as regards integrating children's home experiences of mathematics into ECEC. Relatively little research has addressed how teachers support the connections between children's home experiences and the development of early mathematics skills. This may be due to an underlying assumption that parents are averse to engaging in mathematical ideas with their children (see for example, Lefevre et al., 2002; Skwarchuk, 2009). However, the results from this study show that this is not the case and provide a potential rich source of activities that ECEC teachers can use.

In future projects, the narratives told in PEIs can be enriched if participants indicate their reasons for taking photos at the time they take them. This will also allow a comparison of the individual participants' views of what they consider valuable at the time they take the photos and during the construction of joint narratives in the PEIs, revealing whether and how their views have changed.

Intervention studies using PEIs can also be part of future research. They can move beyond discussing different views to investigating how collaboration can be developed on the basis of those views. This may lead to a better understanding of

how the hidden power relations between teachers and parents operate and provide the teachers with insights into how to achieve the curricula goals for collaboration.

As noted earlier, the original intention of the project was to work with immigrant parents. Given the increasing level of migration into Europe, immigrant parents represent a diversity of languages and cultures and, potentially, views on mathematics education for young children. The insufficient number of immigrant parents in this study means that a more targeted project will be required in the future. This is because cultural differences may mean that narratives about mathematics education will be able to further enrich the set of options for mathematics education for young children that support ECEC. It may also be that teachers need to develop additional skills to investigate and value these different views.

6.5. Concluding remarks

The aim of this project has been to improve the understanding of the contributions that parents can make as collaborative educators. This is because although they have often been described in terms of being responsible educators, they have just as often been situated as responsible educators only if they adopt the points of view of ECEC teachers. The knowledge or point of view of parents offers the potential for alternative social values and experience to be incorporated into the collaboration between teachers and parents.

ECEC educators may collaborate with parents through engagement programmes (Epstein, 2011), which focus on the value of parental engagement while acknowledging that parental engagement is a complex issue (Epstein, 1995). Although noting the importance of social class, economic status, parents' experience of education and children's achievements, Harris and Goodall (2008) showed that there was relatively little evidence of adequate methods of engaging parents. Collaboration between parents and teachers is multifaced. It includes parents coming into ECEC institutions informally as well as more formal opportunities, such as interactions with teachers and participating in their children's early education.

Parents' interactions with teachers in respect of mathematics education for young children should include the sharing of a wide variety of parental experiences. However, as shown in Article IV, it is a challenge for parents and teachers with very diverse backgrounds to share their views. The teachers' focus on building trusting and collaborative relationship amongst themselves and the parents' focus on addressing their children's needs could result in shared views contributing not to collaboration but to competition in which a particular set of views comes to dominate what is considered appropriate mathematics education for young children.

Foucault wrote about the political goals or knowledge that occupies a specific place within an institution as a local configuration of power and knowledge (Foucault, 1980b, 1982). By redefining how knowledge operates, he made clear that knowledge is a justified reality. In Article IV, the interactions between parents and teachers created some resistance to their accepting each other's views as valuable. At times in the interactions, a particular type of knowledge, usually originally brought up by the teachers, became valued by the whole group, leading to a normalisation of views. Such normalisation emerged from discussions of well-established views, often the teachers', rather than from the sharing of alternative and different sets of views.

In this project, parents' views often involved valuing the mathematical topic of counting, including aspects of equivalence. Their views showed that they also found everyday experiences valuable as a useful context for introducing mathematical topics. Findings such as this suggest that parents have generally aligned themselves with policymakers, teachers and society. The question remains whether other ways of sharing views about mathematics education for young children may provide alternative views that are not necessarily in such alignment. It is important to acknowledge the variety of influences on points of view when discussing collaboration between parents and teachers so that parents' views can be incorporated into, but not necessarily replace or displace, teachers' professional knowledge. However, the incorporation of parents' views can help to elaborate on and enrich existing teacher knowledge so that children's opportunities to develop are also broadened.

7. References

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8. Appendices

8.1. Appendix 1: Research approvals from NSD

Research approval number 51400

Tamsin Meaney
Avdeling for lærerutdanning Høgskolen i Bergen
Postboks 7030
5020 BERGEN

Vår dato: 23.01.2017 Vår ref: 51400 / 3 / MSS Deres dato: Deres ref:

TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 02.12.2016. Meldingen gjelder prosjektet:
51400 Fotofortellinger om kulturelt mangfoldige barn i matematiske situasjoner
Behandlingsansvarlig Høgskolen i Bergen, ved institusjonens øverste leder Daglig ansvarlig Tamsin Meaney
Personvernombudet har vurdert prosjektet, og finner at behandlingen av personopplysninger vil være regulert av § 7-27 i personopplysningsforskriften. Personvernombudet tilrår at prosjektet gjennomføres.

Personvernombudets tilråding forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemaet, korrespondanse med ombudet, ombudets kommentarer samt personopplysningsloven og helseregisterloven med forskrifter. Behandlingen av personopplysninger kan settes i gang.

Det gjøres oppmerksom på at det skal gis ny melding dersom behandlingen endres i forhold til de opplysninger som ligger til grunn for personvernombudets vurdering. Endringsmeldinger gis via et eget skjema, http://www.nsd.uib.no/personvern/meldeplikt/skjema.html. Det skal også gis melding etter tre år dersom prosjektet fortsatt pågår. Meldinger skal skje skriftlig til ombudet.

Personvernombudet har lagt ut opplysninger om prosjektet i en offentlig database, http://pvo.nsd.no/prosjekt.

Personvernombudet vil ved prosjektets avslutning, 31.12.2018, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen

Kjersti Haugstvedt

Marie Strand Schildmann

Kontaktperson: Marie Strand Schildmann tlf: 55 58 31 52
Vedlegg: Prosjektvurdering

Research approval number 53595

Dorota Lembrér
Senter for utdanningsforskning Høgskolen på Vestlandet
Postboks 7030
5020 BERGEN

Vår dato: 08.05.2017 Vår ref: 53595 / 3 / AGH Deres dato: Deres ref:

TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 13.03.2017.

Meldingen gjelder prosjektet:

53595 Polish parents and mathematics education in Norwegian preschools. The aim of this project is to provide insights into Polish immigrant parents' views about mathematics in Norwegian preschools.
Behandlingsansvarlig Høgskulen på Vestlandet, ved institusjonens øverste leder Daglig ansvarlig Dorota Lembrér

Personvernombudet har vurdert prosjektet, og finner at behandlingen av personopplysninger vil være regulert av § 7-27 i personopplysningsforskriften.

Personvernombudet tilrår at prosjektet gjennomføres.

Personvernombudets tilråding forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemaet, korrespondanse med ombudet, ombudets kommentarer samt personopplysningsloven og helseregisterloven med forskrifter.

Behandlingen av personopplysninger kan settes i gang.

Det gjøres oppmerksom på at det skal gis ny melding dersom behandlingen endres i forhold til de opplysninger som ligger til grunn for personvernombudets vurdering. Endringsmeldinger gis via et eget skjema, http://www.nsd.uib.no/personvernombud/meld_prosjekt/meld_endringer.html. Det skal også gis melding etter tre år dersom prosjektet fortsatt pågår. Meldinger skal skje skriftlig til ombudet.

Personvernombudet har lagt ut opplysninger om prosjektet i en offentlig database, http://pvo.nsd.no/prosjekt.

NSD – Norsk senter for forskningsdata AS Harald Hårfagres gate 29 Tel: +47-55 58 21 17 nsd@nsd.no Org.nr. 985 321 884
NSD – Norwegian Centre for Research Data NO-5007 Bergen, NORWAY Faks: +47-55 58 96 50 www.nsd.no

Personvernombudet vil ved prosjektets avslutning, 30.06.2018, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen

Kjersti Haugstvedt

Agnete Hessevik

Kontaktperson: Agnete Hessevik tlf: 55 58 27 97

8.2. Appendix 2: The introductory page of the survey

Polish parents and mathematics education in Swedish preschools

The Introductory page of the survey (Information in English)

This information will be added on the first page of the online survey. Participants will be able to access this information and choose to not participate in this study.

In this online survey, you will be ask to answer both open-ended questions and multi-choose questions. These questions are about your perspectives on mathematics activities of your own and your children. By filling out this online questionnaire, you understand that SurveyPlanet will store your IP address, cookies and/or browser information. It is voluntary to participate in the project.

All personal information will be treated confidentially. Personal information will be stored on the research server at Western Norway University of Applied Sciences. This institution is responsible for the project. The project is scheduled for completion in 30th of June 2018. All data will then be anonymised.

If you have any questions, please contact Dorota Lembrér by email dorota.lembrer@telia.com, or phone 0730 677 146

8.3. Appendix 3: Consent letter (In Norwegian)

Forespørsel om deltakelse i forskningsprosjektet

"Fotofortellinger om kulturelt mangfoldige barn i matematiske situasjoner"

Bakgrunn og formål
Studiet gjennomføres av forskere ved Høgskulen på Vestlandet. Det går ut på å undersøke hvilke matematiske situasjoner foreldre og lærere anser at kulturelt mangfoldige barn engasjerer seg i, i hverdagen.

Deltakerne er valgt fordi de har barn i barnehage eller er lærer i barnas barnehage.

Hva innebærer deltakelse i studien?
Deltakerne vil bli gitt et digitalt kamera og bedt om å ta bilder av barn i situasjoner, som de mener innebærer matematisk aktivitet. Bildene forventes å bli tatt i løpet av en uke i mai. Deltakerne vil ha muligheten til å slette hvilket som helst bilde før de leverer kameraet tilbake. Forskeren vil velge et par bilder og intervjue foreldrene og lærerne om hvilken matematisk aktivitet de ser på bildene og hvorfor. Intervjuene vil være med foreldrene i små grupper og med lærerne i små grupper. Det er forventet å ta 20-60 minutter, avhengig av antall deltakere i intervjuet. Intervjuene vil bli spilt inn på video. De er tenkt gjennomført en ettermiddag den første eller andre uken i juni 2017.

Hva skjer med informasjonen om deg?
Alle personopplysninger vil bli behandlet konfidensielt. Personopplysninger, bilder og video-opptak vil bli lagret på forskningsserveren ved Høgskulen på Vestlandet. Bare 8 forskerne i forskningsgruppen vil ha tilgang, og alle opplysninger vil være anonymisert.

Foreldre, lærere, barn og barnehage vil ikke kunne gjenkjennes i publikasjoner.

Prosjektet skal etter planen avsluttes i desember 2018. Alle bilder og videoopptak vil da bli destruert.

Frivillig deltakelse
Det er frivillig å delta i studien, og du kan når som helst trekke ditt samtykke uten å oppgi noen grunn.
Dersom du trekker deg vil alle opplysninger om deg bli slettet.

Dersom du ønsker å delta eller har spørsmål til studien, ta kontakt med Troels Lange, tel. 55 58 55 76 eller Tamsin Meaney, tel. 55 58 55 69.

Studien er meldt til Personvernombudet for forskning, NSD - Norsk senter for forskningsdata AS.

Samtykke til deltakelse i studien

Jeg har mottatt informasjon om studien, og er villig til å delta.

(Signert av prosjektdeltaker, dato)

Jeg samtykker også til at mitt barn kan delta.

(Signert av prosjektdeltaker, dato)

8.4. Appendix 4: Consent letter (In English)

Request for participation in the research project

"Photo Stories about culturally-diverse children in mathematical situations"

Background and purpose
The study is conducted by researchers at Western Norway University of Applied sciences. It involves examining the mathematical situations that parents and teachers consider culturally-diverse children engage with in everyday life. Participants are chosen because they have children in kindergarten or are teachers in the children's kindergartens.

What does it mean to participate in the study?
Participants will be given a digital camera and asked to take pictures of children in situations, which they think involves mathematical activity. The photos are expected to be taken during one week in May. Participants will have the option to delete any photos before they return the camera. The researcher will select a few photos and interview parents and teachers about what mathematical activities they see the children engaging with in the photos and why. The interviews will be with their parents in small groups and with teachers in small groups. It is expected to take 20-60 minutes, depending on the number of participants in the groups. The interviews will be recorded on video. They are intended to be conducted one afternoon the first or second week of June, 2017.

What happens to your information?
All personal information will be treated confidentially. Personal information, photographs and video recordings will be stored on the research server at Western Norway University of Applied Sciences. Only the eight researchers in the research group will have access to the information and all information will be anonymised.

Parents, teachers, children and the kindergarten will not be recognisable in research publications.

The project is scheduled for completion in December 2018. All photos and videos will then be destroyed.

Voluntary participation
It is voluntary to participate in the study, and you can at any time withdraw your consent without giving any reason. If you withdraw all your information will be deleted.

If you have any questions about the study, please contact Troels Lange, tel. 55 58 55 76 or Tamsin Meaney, tel. 55 58 55 69.

The study is reported to the Privacy Ombudsman for Research in NSD - Norwegian Centre for Research Data AS.

Consent for participation in the study

I have received information about the study, and are willing to participate.

---------- ---------- ----------
(Signed by the project participant, date)

I also agree that my child can participate.

---------- ---------- ----------
(Signed by the project participant, date)

9. The articles of the thesis (I–IV)

Article I: Lembrér (2018)

Polish parents' views on mathematics activities at home and in Swedish preschools

DOROTA LEMBRÉR

This article describes the results of a digital survey of 41 Polish immigrant parents' views on mathematics activities at home and at preschool as parents' views potentially provide a range of perspectives on mathematics activities for young children. Parents were asked to describe and justify their views about how children engage with mathematical ideas and nominate activities that children engage in at home and at preschool. When parents justified their views about young children and mathematics, they tended to align themselves with the norms and values of the Swedish preschool curriculum. The findings suggest that parents, like children, are socialised into Swedish preschools. However, this alignment could limit possibilities for broadening perspectives about mathematics education in preschool, which could be available by incorporating input from immigrant parents' different cultural and linguistic backgrounds.

It is often stated in research that parents and families play a role in children's learning and development (Melhuish et al., 2008) and that children's mathematics can be supported through families and preschool teachers working together. For example, in a study in Germany, parents could borrow books and games from preschools so that they could engage with their children in mathematics activities at home (Streit-Lehmann, 2017). In the Swedish preschool curriculum (Skolverket, 2016, p. 4), it states, "the task of the preschool means working in co-operation with parents so that each child receives the opportunity of developing in accordance with their potential". Later it stated, "parents should have the opportunity within the framework of the national goals to be involved and influence activities in the preschool" (p. 13). These comments suggest that a partnership between parents and preschools would contribute to a shared responsibility for children's education.

While it is important to consider how preschools can support parents to engage in mathematics activities at home, it is also important to value

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Lembrér, D. (2018). Polish parents' views on mathematics activities at home and in Swedish preschools. *Nordic Studies in Mathematics Education*, 23 (3-4), 185–201.

the mathematical activities children do outside of preschool (Brenner, 1998). As the first "educators" of young children, parents often have a range of opportunities and resources to engage in children's learning (Phillipson, Gervasoni & Sullivan, 2017), which could contribute to broadening what could be offered at preschools.

With increasing migration in Europe, immigrant parents represent a diversity of languages and cultures. As Van Laere and Vandenbroeck (2017) stressed inclusion of minority groups' perspectives can reveal and confront similarities and differences between teachers and parents about early childhood education. In this way, immigrant parents could contribute to research and political debates, which might in turn might broaden perspective on children's mathematics activities.

However, parents' views are rarely considered as possibilities for broadening perspectives on mathematics activities at preschools, particularly when the parents come from a different cultural background. For example, Lunneblad and Johansson (2012) suggested that parents' engagement in early learning in Sweden is related to their fluency in the Swedish language and knowledge about the educational system. If for example, parents have little awareness that they can contribute, then they are unlikely to identify possibilities for engaging with their children's preschools.

It is therefore not surprising that there has been little research into the impact of immigrant parents' influence on pedagogical practices in preschools. Consequently, my aim in this article is to present immigrant Polish parents' views and ideas about mathematics activities for young children in Swedish preschool as a basis for a later study considering how preschools could benefit from these views. In 2011, Polish citizens were the third largest group of immigrants in Sweden (Statistics Sweden, 2012). As such, their perspectives have the potential to give detailed insights into learning mathematics in a new country.

My research question is: What insights do immigrant parents' views about mathematics in Swedish preschools and at home provide about socialization processes? In the next section, I describe the socialisation processes of creating/recreating valued practices, including mathematical practices, in society. Thereafter, previous research on immigrant parents' views about mathematics of young children is described. Finally, I present the analysis of the data from a digital survey.

Socialisation process and parents' engagement in preschool

Socialisation is the theoretical lens for this research as preschools and homes can be thought of as settings into which children are acculturated

as active, knowledgeable and skilled individuals, while at the same time becoming enculturated into institutional norms and values. Norms are sets of and expected behaviours that are held by members of society and which are adopted through the socialisation process (Lee, 2001; Prout, 2011). Consequently, socialisation is about how people create meaning through their experiences, interests and views, as they engage in society, and includes the creation and recreation of norms and values and skills and knowledge (James, Jenks & Prout, 1998; Lee, 2001). Socialisation can result in creating a variety of norms and values in different societies, cultures and social groups, as people, who inhabit a society, create it (Ebrahim, 2011). This can be considered as contributing to the framing of the processes of learning (Lee, 2001).

Socialisation situates society members as recreating relevant knowledge, in order to reproduce cultural values from one generation to another (James et al., 1998; James & Prout, 2001; Qvortrup, 1994). For example in the Swedish preschool curriculum (Skolverket, 2016), democratic citizenship, subject learning and respecting children's own interests are to be passed on to children as the most relevant norms and values of the Swedish society. What is included in the curriculum in turn influences how activities are implemented and children are then socialised. Interactions, both planned and spontaneous, in Swedish preschools are likely to recreate these norms and values.

As children and their families are situated within a social, political and historical context, James et al.'s (1998) theory of socialisation describes childhood as being structured by society, in which children are regarded as social actors. In studies of childhood (Corsaro, 2005; James et al., 1998; Prout, 2011), children are seen as human beings in their own right and as such their lived experiences in different environments should be taken into consideration. Through socialisation, children are socially constructed and become active participants in constructing their own cultures and contributing to society. However, as socialisation is a social process, the role of others, such as adults and peers, in children's learning is important (Prout, 2011). Therefore, there are possibilities for parents to contribute to determining, both through creation and recreation, the norms and values which should be valued in preschools.

Nevertheless, it is generally expected that newcomers will adopt the societal norms, values and perspectives, rather than the society take on the norms and values of the newcomers (Lunneblad & Johansson, 2012). Swedish preschools are built on the belief that if all children receive the same socialisation, they will share the same core values and perceptions (Jönsson, Sandell & Tallberg-Broman, 2012). However, this perspective views societal norms and values as static, with existing norms being

sustained over time. In contrast, immigrant families' views could contribute to the creation of new norms and values that recognises the changing nature of that society.

In this study, I analyse Polish immigrant parents' explanations and justifications, about mathematics activities that their children do at home and at preschool, to identify whether they are valuing norms and values from Polish or Swedish culture or creating new ones by merging norms and values in new ways. As such, parents' views provides insights into the socialisation processes that are affecting them.

Socialisation and children's mathematics activities

As places of socialisation, preschools and homes are involved in the construction of childhood through interaction with others (Prout, 2011), around activities including mathematical activities. In homes and preschools, children engage in mathematics activities from an early age so that they come to see the relevance of using mathematics in everyday life and exploring mathematical terms. For example, they learn about direction, by pointing at objects (Björklund & Pramling, 2017) and how to describe where things are, including themselves.

Preschool is a place where children's social contexts and experiences are formed and so mathematics activities are framed by its norms and values (Lembrér, 2015), connected to the goals and guidelines prescribed in the curriculum. The curriculum indicates that preschools need to ensure that each child "develops 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" (Skolverket, 2016, p. 10). The curriculum also sets out that children's interests and experiences are useful starting points for achieving all the goals and guidelines (Skolverket, 2016). As Prout (2011) stressed, it becomes important to understand children's engagement in different environments. Therefore, it could be possible for mathematics activities to be driven by experiences from both preschool and home that children are interested in.

Research has shown that children acquire understanding, skills and awareness of different mathematical concepts from experiences outside educational institutions (Bottle, 1999; Brenner, 1998; Carruthers, 2006). Aubrey, Bottle and Godfrey (2003) suggested that children's early experiences of numeracy at home, such as cooking or playing card games, are important for understanding how numeracy develops during later schooling. They found that parents and children shared many common activities, such as counting snacks, reading, number games or building

toys, which provided opportunities for parents to incorporate numbers into their children's everyday routines. The results gave insights into the complexity of how children's knowledge is influenced by the home environment and their dialogues with parents and illustrates how socialisation processes operate (Prout, 2005).

Home experiences provide children with the possibility to link their interests and experiences with mathematical knowledge and skills that are presented in preschool activities (see for example, Edo, Planas & Badillo, 2009; Lembrér & Meaney, 2015). However, when preschool teachers plan mathematics activities for children, Wager and Whyte (2013) suggested that they used children's home mathematical experiences in two ways. The first involves only recognizing home activities, that were already familiar to the preschool teachers. The second involves integrating children's home experiences that were initially unknown to preschool teachers into planned activities. It may be that immigrant parents' views about mathematics activities would not be recognised as valuable, depending on their familiarity to teachers. As Hawighorst (2005) stressed, parents' views on mathematics education can provide knowledge about childhood and broaden perspectives on mathematics and learning of mathematics, only if those views are recognised as legitimate.

Socialisation will also affect parents' views of the kinds of mathematics their children should engage in as socialisation affects all members as participants and contributors to the society (Corsaro, 2005; James et al., 1998; Prout, 2011). Immigrant parents, like their children, are in the process of socialisation as soon as they begin to settle in the new society. I argue that parents' views on mathematics activities are embedded in socialisation processes, drawing as they do on both understandings from the previous and new societies that they have engaged with. When analysing parents' views, it is possible to identify their creation and recreation of societal norms and values. Immigrant parents' views can provide insights into how the socialisation process affects their views about their children's mathematics activities. Knowing how socialisation operates can provide possibilities for both parents and preschool teachers to discuss similarities and differences between their views and to build a common understanding about how to collaborate around children's mathematics activities.

Data Collection

In order to determine how Polish parents, as representatives of immigrant parents in Sweden, viewed mathematics for their young children, I designed a digital survey to gain a general impression of their views.

Cohen, Manion and Morrison (2000) stated that a survey should focus on views or opinions from a group of the population, rather than individuals. If an individual is of interest, then a semi-structured interview is more suitable (Cohen et al., 2000). The survey ensured that each participant responded to the same set of questions and their participation was taken as an active choice to participate. The digital survey allowed participants to answer questions at their convenience, withdraw from participation any time and to read their answers on the computer screen as they responded. This was not something which could be achieved with a semi-structured interview where it is more difficult to revisit answers and change them.

The survey was open on 29th of June and closed 30th of November 2016 and was provided in Polish and Swedish. Answers were translated into English.

The participants were contacted through a snowballing approach (Cohen et al., 2000). An invitation to participate in the digital survey was published as a URL link on a website for a Polish organisation and an internet forum for Polish citizens living in Sweden. It included an invitation to share the URL link with others. Due to the manner in which the participants were contacted, the data formed a convenience sample and thus is not representative of the whole population of Polish parents in Sweden. As such, the survey results give information from participants who chose to explain their views and were willing to answer a survey (Coyne, 1997).

There were 41 participants (2 males, 39 females), aged between 22 and 58 years, who had lived in Sweden between 2 and 40 years. 31 of 41 parents had attended preschool in Poland. 39 parents had children attending preschool in Sweden, whilst 2 participants had children who attended preschools in Poland.

No data which could identify individual participants were collected. In the results section, participants are described as P1 to P41.

The survey

The digital survey consisted of 16 questions and was divided into four parts. In the first part (Questions 1–5), participants were asked to give gender; age; number of years living in Sweden; and respond to the questions "Did you attend preschool in Poland?" and "Do you have children who are attending (or attended) preschool in Sweden? These questions were asked to ensure that the Polish parents had experiences of Swedish preschools.

In the second part of the survey (Questions 6–10), the participants were asked to answer questions and describe mathematics activities. Participants were asked to describe their own experiences of learning mathematics in Polish preschools, plus their views on the kinds of activities that their children engaged in at home and at preschool. These questions were adapted to the contexts of Polish and Swedish preschools.

The third part of the survey, questions 11 and 12, required participants to nominate the mathematics activities children did at home and at preschool. The multiple choice questions were based on activities identified in previous research. Studies such as those by Aubrey et al., (2003) and Bottle (1999) identified a set of everyday activities and experiences of young children, initiated by both children and by adults, which could be connected to mathematics learning. The mathematics activities that Bottle (1999) observed in homes were: number and counting; doing puzzles; making towers; putting things in and taking them out again; and quantities like full, empty and half full. Aubrey et al., (2003) also observed counting rhymes and reading stories that focused on number. A similar choice of examples were provided in two multi-choice questions, determining whether the parents considered that they happened at home and/or at preschool. The five activities were: counting rhymes; jigsaw puzzles; counting things; playing with sand and water; and building with blocks. "Counting rhymes" and "counting things" indicate that the children were using numbers to label something or to give it a numerical value (e.g. five is always before six and after four, registration plate on a car). "Jigsaw puzzles" is about visualizing shapes in various ways. "Playing with sand and water" and "building with blocks" are activities where children compare objects, describe where things are positioned, copy, represent or arrange things. Participants could choose more than one activity from five activities presented in multi–choice questions.

The last part of the survey (Questions 13–16), included questions about participants' views on learning of mathematics and language. Question 13 was linked to the previous two multi-choice questions, with participants being asked to justify why and how they viewed these activities as learning opportunities for their children. Question 14 and 15 was intended to find out about parents' views on language learning as an element of mathematics learning (e.g. Civil, Bratton & Quintos, 2005; Giovannini & Vezzali, 2011). Question 15 was linked to Question 14 and included three statements about learning of mathematics and learning the Swedish language. However, the participants' answers to Question 14 and 15 were minimal and did not provide any useful data. Question 16 provided an invitation to parents to share with preschool teachers something about their children's learning of mathematics. Participants

were also asked to express what was important for them based on their own experiences of mathematics. This provided longer responses.

Data analysis

The data were initially examined to identify how the parents' views about mathematics activities of their children were related to creation and recreation of the norms and values of their country of origin or the norms of Swedish society as recognised by the goals and guidelines prescribed in the Swedish preschool curriculum (Skolverket, 2016). Parents' views were considered to be about creating norms and values when they justified or explained children's mathematics activities as being shaped as something that combined established or adapted norms and values in new ways. Recreation was considered to be when parents' views seemed to be solely based on established societal norms and values from Polish or Swedish society. The norms and values that were recreated included aspects of mathematics knowledge and skills, described in the preschool curriculum (Skolverket, 2016).

In the next section, I describe the results of the multi-choice questions about mathematics activities children might engage with and a thematic analysis of the open-ended questions where the parents were able to elaborate their views on their children's mathematics activities.

Parents' views about mathematics activities

It became clear from the data in digital survey that the Polish parents' views mostly seemed to recreate the norms and values of the Swedish society. Many of the views were very similar to what was proposed in the guidelines and mathematics goals in the Swedish preschool curriculum (Skolverket, 2016).

Although not directly linked, the fact that parents considered that their children participated to a similar degree in activities at home and at preschool indicates that the parents did not see themselves as doing other things at home to what was done at preschool. This can be see in the results of the multiple choice question about the five mathematics activities, presented in figure 1.

Figure 1 shows that most of the Polish parents in the survey considered that their children engaged in mathematics through the same activities at home and at preschool. As some activities were chosen by different amounts of parents, it seems that parents could distinguish between the activities that children did. Therefore, as children's first mathematics educators (Phillipson et al., 2017), this awareness about the mathematics

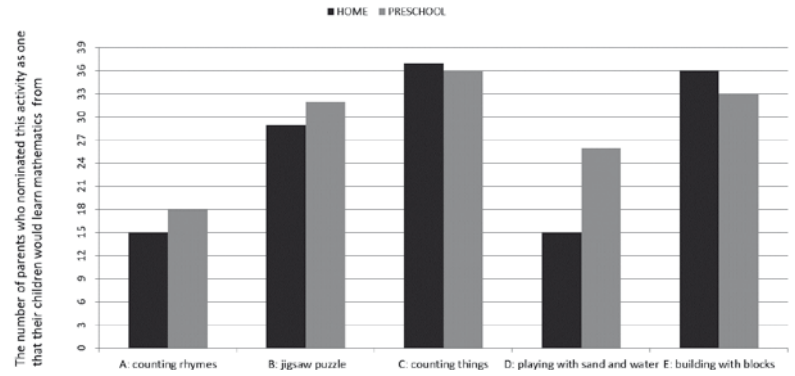

Figure 1. *Numerical frequency of home and preschool activities*

activities indicates that parents have information that could be used to discuss children's possibilities for engaging with mathematical ideas with preschool teachers and collaborate about the activities children do both at preschool and at home.

Thirty-seven out of forty-one participants identified *counting things* as something children would do at home and almost the same number, thirty-six out of forty-one, selected *counting things* as something done in preschool. The results in figure 1 suggest that these Polish parents valued these activities sufficiently to do them at home, in this way recreating a norm that situates counting things as a coherent basis for children's early knowledge about quantities. This would be in alignment with the view of researchers, such as Clements and Sarama (2007) who highlighted that counting activities, such as answering a question "How many?", develop children's understanding and skills that will be valuable for later mathematical learning.

These results are supported by comments made in the final question (16), in which parents could share something about their children's learning of mathematics. Many parents described everyday activities, such as: counting things; classifying objects; doing arithmetic; recognizing numerical symbols; playing with Duplo blocks. These comments reinforce the idea that parents considered counting to be valuable skill to be developed and something that they encouraged at home.

As well some of the parents gave examples of everyday activities in which mathematics could emerge. For example, playing shop is given as an example by P33 as a way of learning about quantities and amounts. P33 stated: "They learn mathematics when they play the "shop" – buying things (quantity, amount), and counting money". The parents also explained that they were viewing *counting activity*, as a common activity

in preschool. For example, P39 justified that children gained knowledge about counting when they engaged in activities in preschool (Question 16), "At the preschool children learn mathematics in everyday activities, such as counting fruit pieces or the amount of blocks on the tower." By stating that children, "learn mathematics in everyday activities", P39 reinforced the importance of counting activities. This suggests that many of the Polish parents had been socialised into accepting the importance of *counting* as their responses seemed to recreate norms and values about how it should be carried out.

The parents' views about counting are in alignment with a mathematical goal in the preschool curriculum (Skolverket, 2016), in which quantity, order and number concepts are highlighted. However, it is not clear whether the Polish parents, living in Sweden, would consider counting activities more more or less valuable than if they had been living in Poland. Further research is needed to determine if counting things is also highly valued as knowledge worthy of recreating by parents in Poland.

However, it is interesting to note that *counting rhymes*, was not seen by the parents as something their children did as often at home or at preschools as counting things. There are many traditional rhymes and verses related to basic numeracy in both Polish and Swedish. However, it seemed that *counting rhymes* were not something that parents considered that preschools would do or that they would do at home as mathematics activities with children. This finding is interesting in that it seems to indicate that counting rhymes was not considered to be a societal norm about valued mathematics which needed to be recreated at home and at preschool by as many parents, which is different to what was indicated in an earlier study situated in UK (Aubrey et al., 2003). However, further research is needed to determine whether it is that counting rhymes in themselves were not valued or if the connection between counting rhymes and mathematics was not valued.

The only activity where there was a large difference between what was considered as being done at preschool and home was the activity D: *playing with sand and water.* Just over a third of parents chose this activity, as something their children engaged in at home (15 out of 41), compared to 26 who saw it as something children did at preschool as a mathematical activity. P17 justify her/his view on this activity (Question 13) by writing:

> P17: I do not think that playing in a sandbox has a greater impact on mathematics, unless children count or work with some kind of toys and for example, can divide toys between each other.

For P17 and perhaps others who did not nominated this activity, *playing with sand or water* is not likely to contribute to children gaining or using

children's existing mathematical knowledge. The activity *playing in a sandbox* is not viewed as valuable because in of itself it is not mathematics. It is only mathematical if children count or work with some kind of toys that provide experiences the parents valued as mathematics. Although some parents did nominate this activity as something which could be considered as a mathematical activity as preschool and to a lesser extent at home, it is unclear whether this perspective is a result of their experiences from Poland or affected by having children attend Swedish preschools. More research is needed to see whether parents who did nominate it as a mathematical activity done at preschool did so because they saw it as creating new norms and values. However, it may be that a simple explanation for the differences between home and preschool is that parents did not have the facilities to play with sand and water at home.

Attendance at Polish preschools did affect parents' views. For example, in response to question 10, P11 wrote, "they (her children) attended Polish preschools and learnt exactly the same ways as I did at their age". P11's view was that Polish preschools practices had not changed in the generation since she had attended preschool. This suggests that she considered Polish preschools to be sites for recreating norms and values across time and this was perhaps not appropriate. However, given that there were few comments about Polish preschools, more research is needed to follow up on how these experiences affected parents' views.

Some of the parents explained how mathematics activities were transferred from preschool to home, where the norms and values of these activities were recreated. P2 gave example of an activity (Question 9) where her child asked about the names of different shapes and used this knowledge in different situations.

> P2: Children learn basic shapes while playing. Shapes are used in different situations and aspects. My child comes home and continues to ask us about different shapes "which is a shape of"?

P2 seemed to have accepted that knowing shapes is valuable knowledge for children, and as a parent she should contribute to recreating the norms and values that reinforce how this knowledge should be taught. For example, dialogues with adults seemed to be accepted as contributing to children gaining appropriate mathematical knowledge and that mathematics activities done at preschool can be transferred to home. As James et al. (1998) explained, active recreation of societal norms lead to a construction of childhood where children through participation in activities have the support of adults who are in alignment on what knowledge and skills should be transferred and how.

Views about mathematics activities in the Swedish preschool

In the previous section, it did seem that parents considered that existing norms and values were being recreated both at preschool and at home but it was not always clear whether views of these norms and values had arisen from experiences in the Swedish or Polish culture. In this section, the parents' views reinforcing the recreation of certain norms and values similar to the goals and guidelines in the Swedish preschool curriculum (Skolverket, 2016) are discussed, particularly in regard to the pedagogical practices used to support children to gain important mathematical knowledge.

When it came to the views about pedagogical practices in preschool, the parents emphasised the value of children's participation in activities designed or adapted by preschool teachers (Skolverket, 2016). P26 wrote, "Everything depends on the methods the preschool teacher chooses. In addition, how the teacher will use the available material" (Question 8). As well, some parents were clear that leadership and creativity were needed by a preschool teacher for interactions with children to result in mathematics learning. For example, P31 wrote "children learn mathematics activities in all situations, when the preschool teacher can lead them". P20 suggested, "everything is in the hands of a creative teacher". In these quotes, a similarity can be seen with how teachers' responsibilities for developing activities are situated in the curriculum, in that "The preschool should promote play, creativity and enjoyment of learning, as well as focus on and strengthen the child's interest in learning and capturing new experiences, knowledge and skills" (Skolverket, 2016, p. 9). Thus, the parents seemed to be in alignment with the curriculum in recreating this norm about appropriate pedagogical practices. The parents' views indicate that they are aware of the norms for accepted pedagogical practices, and emphasise them rather than other aspects of learning mathematics in preschool.

Aspects of the mathematics goals in the Swedish preschool curriculum (Skolverket, 2016) seemed to be reflected in some of the parents' views. For example, P11 emphasised the value of learning mathematical terms and problem solving.

> P11: Learning mathematics, vocabulary and mathematical concepts is necessary for children. They develop their abstract thinking, analysing, reasoning and decision-making processes. (Response to question 16)

P11's view about what is important in mathematics mirrors the goal in the curriculum, which states that preschools were responsible for children to "develop their ability to distinguish, express, examine and use mathematical concepts and their interrelationships; develop their mathematical skill in putting forward and following reasoning" (Skolverket,

2016, p. 10). By echoing what was in the Swedish preschool curriculum, P11 seemed to have accepted the need to recreate in children these aspects of mathematics through interactions in preschools. This suggests that at least some of these Polish parents seemed to have been socialised into the need for children to gain valued knowledge about mathematics, recreating accepted societal norms and values of Swedish preschools.

The value of play as a way to learn mathematics also seemed to be accepted by many of the Polish parents. Play-activities, such as, a pretended play with toys and engaging in games with other peers, were justified by the parents as being highly valued in Swedish preschools. P29 and P13 viewed play as an approach for learning mathematics. When responding to question 16 and sharing their views on how children could learn mathematics, they stated:

P29: In preschool, play is the main form of learning. Children are enthusiastic and learn about the world around them through play. They should receive many interesting incentives in order to actively gain knowledge about the world in general, as well as the mathematical world.

P13: I like it here (in Sweden), that children have a lot of freedom in choosing and directing their play activities.

A particular aspect of play that P13 highlighted was that children could make their own decisions, situating them as active participants in the activities. This was an aspect of Swedish preschools that P13 valued, which recreated the norms about learning mathematics through play that were in the Swedish preschool curriculum (Skolverket, 2016). In the curriculum, it is stated that preschools should "promote play as well as focus on and strengthen the child's interest in learning" (Skolverket, 2016, p. 9).

In several examples, children's engagement in play was acknowledged as important for their learning. P37 wrote: "Learning through play is important". The Swedish preschool curriculum (Skolverket, 2016) provides an elaboration of why play is important, "play and enjoyment in learning in all their various forms stimulate the imagination, insight, communication and the ability to think symbolically, as well as the ability to co-operate and solve problems" (p. 6). The curriculum indicates that children should use their interests and experiences when acquiring mathematical knowledge and skills in play activities. It can be assumed, that the parents' views, such as P29 and P11, are influenced by their experiences of having children attending preschool in Sweden. Thus, the Swedish preschool, as an institution, contributes to parents and families recreating the accepted norms and values about how mathematics should be learnt valued in the curriculum.

In summary, socialisation process includes recognition of norms and values, which members of a society learn to interpret (James et al., 1998; Prout, 2011). The Polish parents' views about mathematics activities of their children at preschool and at home show that they have recognised and come to value norms and values around mathematical activities presented in Swedish preschool. These parents exemplified preschool activities based on play as a valuable contribution to children's learning. The views of these parents shows an agreement with the norms and values without any expectations that their children would have opportunities to engage in a different variety of mathematics activities at preschool.

Conclusion

In this article, I have presented the views of 41 Polish parents about their children's mathematics activities, at home and in Swedish preschools. This was done to provide insights into the socialization processes. The analysis shows that generally parents recreated norms and values about mathematics knowledge that the young children should learn which appear to be universal, at least in Europe, whereas expectations about how children learn seemed to be connected to Swedish preschool.

The results in figure 1 show that parents considered that similar activities are done at home and at preschool to provide children with opportunities to learn mathematics. 31 of 41 parents had attended preschool in Poland, so it may be that parents held these views of mathematics activities before coming to Sweden. This view is reinforced by these activities being valued in research from families in other countries (Aubrey et al., 2003; Bottle, 1999). More research is needed to clarify how parents' perspectives on mathematics activities develop.

Swedish preschools seemed to have influenced Polish parents' views about how learning mathematics should occur, particularly in regard to pedagogical practices such as through a play-based approach. Therefore, the parent's accounts of the mathematics knowledge that children gain in preschool and at home suggest that they have been socialised into recreating the norms and values expressed in the Swedish preschool curriculum's goals and guidelines.

This recreation of values and norms indicates that socialisation may have become restricted in that there did not seem to be any possibilities for new norms and values to be created, either by combining or adapting norms and values that parents had gained from living in two countries. The socialisation process could have been restricted by a range of factors. One of these could have been the influence of the curriculum on what preschool teachers offered as mathematical activities. Another

factor could be linked to research about the gaps and struggles in regard to immigrant parents' involvement with educational institutions (Civil et al., 2005; Giovannini & Vezzali, 2011). If the opportunities offered by preschools focus on integrating into the existing views of mathematics education, then opportunities will be lost for a diversity of norms to be recognized and for the creation of new norms. In this way the experiences of parents as first educators could be excluded when developing children's mathematics activities in both environments. Therefore, I suggest that dialogues between preschool teachers and immigrant parents, together with children, could provide possibilities for the creation of new knowledge, which incorporates the parents' cultural and linguistic backgrounds. Given that Scandinavian societies are confronting diversity of culture, language and perspectives about mathematics education such dialogues are essential.

This study indicates that further research is needed into parents' and preschool teachers' own definitions of mathematics for young children. This could be a starting point for discussions about similiarities and differences which could be the basis for creating new norms and values.

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Article II: Lembrér (2019)

Using photo-elicitation in early years mathematics research

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In this paper, I examined the use of photo elicitation interviews as a method for gathering data from parents, whose views are not often investigated in research in early childhood mathematics education. The parents shared and discussed photos of their children engaged in mathematics. This method for gathering parents' views is investigated using Bourdieu's theoretical lens of the field. The findings suggest both advantages and disadvantages that established rules of the field which could interfere with or enhance relationships. Photo-elicited interviews can provide insights into parents' knowledge, experiences and views, revealing broader perspectives on mathematics activities at home. However, the choice of photos influenced the interview, limiting or silencing parents if they were unable to recognise any mathematics in what the children were doing in a photo.

Keywords: Home environment, parents, photo elicitation interview, research methodology

Introduction

In this paper, I discuss the advantages and disadvantages of using photo elicitation focus group interviews to gain insights from nine parents, who have children in preschools in Norway, about mathematics education at home. In a photo elicitation interview (PEI), a single photo or a set of photos are used as stimuli during a research interview (Hurworth, 2004).

Vasilyeva, Laski, Veraksa, Weber, and Bukhalenkova (2018) concluded that parents' involvement in school and preschool practices has a significant impact on children's development and learning. Studies have shown that there is generally a positive association between parents' engagement in their children's education and students' academic outcomes (e.g., Galindo & Sheldon, 2012). These studies concluded that parents and family members have a role in children's achievement in preschool and school. Therefore, it is not surprising to find that parents' funds of knowledge when interacting with children at home have been recognised by researchers (Björklund & Pramling, 2017), with parents and families being acknowledged as children's first educators (Phillipson, Gervasoni, & Sullivan, 2017). The relationships between parents, teachers and children has consequences for children's engagement with mathematics.

Nevertheless, issues remain about the kind of role parents are expected to have. Most research focuses on parents' limited ability to support their children's mathematics learning at home. Although parents might feel welcome at preschool (Hujala, Turja, Gaspar, Veisson, & Waniganayake, 2009), Whyte and Karabon (2016) suggested the communication is typically one-way, from preschool to home. Although parents, such as immigrant parents, can have different views (Civil, Bratton, & Quintos, 2005), their views about mathematics done at home are often marginalized or absent in mathematics education research (Milner-Bolotin & Marotto, 2018). It is the teachers' expertise which is expected to enhance parents' awareness of their children's learning of mathematics (Streit-Lehmann, 2017). Consequently, some researchers, such as Anderson and Anderson (2018), have stressed the need for more understanding of the mathematical experiences of young children that adults mediate at home. To conduct research which values parents' views about mathematics education for young children at home there is a need for an appropriate methodology.

To better understand the views of parents about the mathematics that their children engage with at home, I wanted to use photo elicitation interviews. PEIs are considered more effective in gaining insider views than information gained through exclusively verbal methods (Hurworth, 2004). In PEI, participants are asked to take photos on a topic (Epstein, Stevens, McKeever, & Baruchel, 2006). Using the photos as stimuli in interviews supports participants to reflect on a moment or an action (Torre & Murphy, 2015). Frith and Harcourt (2007) stated, "We saw the photographs as a reference point to be used in conversation rather than an objective representation of reality that has a meaning independent of these conversations" (p. 1342). Conversations around photos of everyday life can provide understandings how both the photographer and the viewer construct meaning. Thus, PEI are considered to facilitate dialogues that participants find enjoyable (Pain, 2012) and which enhance collaborative and participatory forms of data collecting.

In early childhood studies, photo elicitation has been used in several ways to try to gain participants' views on particular issues. Clarke and Robbins (2004) stated that discussions between parents and teachers when sharing photos taken by the parents created opportunities for a better understanding of aspects of activities captured in these photos: "The nature of these and the parents' ability to articulate them was a surprise to many of the teachers in the project" (p. 181).

In this paper, I examine photo elicitation interviews as a methodology for gathering data from parents about their views on mathematics. The paper is divided into three further sections. First, I outline Bourdieu's notion of a field as the theoretical framework for identifying the advantages and disadvantages for gathering data in this way. Secondly, I describe my study of parents' views, before, finally, I use examples from my study to discuss PEI's advantages and disadvantages.

Theoretical framework

Parents' involvement in and preparations for PEI occur within power relationships, as they are influenced by the knowledge they have about the subject of mathematics and how this knowledge is then described by the researcher. As well, within a social situation such as the group interview, there is a negotiation of power and this determines which parents' views are heard. Thus, I have used Bourdieu's notion of a *field* to consider how parents and their social positions are located (Bourdieu & Wacquant, 1992). Social positions refer to the knowledge, skills, resources and dispositions that parents take into their discussions with other parents and myself as the researcher. These inform the types of relationships that parents have in society and with the institution of preschool.

Key aspects of Bourdieu's notion of a field are production and the material resources of power and capital. Capital refers to the variety of resources, noticeable and hidden, through which agents can further their aspirations and achieve "success" in the field (Bourdieu, 1975). A social position arises from an interaction between the rules of the field, the parent's habitus and the parents' capital (social, cultural and economic). The field is the social arena in which positions are available for agents, each with a different habitus (behaviour, dispositions to act in the social world), and which are constructed by relations between agents in this field. These relations are bound by rules, which are dynamic in that they can differ within the field and be changed and adjusted by circumstances. Additionally, understanding the impact of capital can help to unpack and explain what is hidden, for example, in the parents' photos as it determines what is valued as mathematics activity. Identifying the capital

that parents make use of within PEIs provides an opportunity to see how this affects their sharing of views.

Habitus can also help to unpack the set of dispositions parents use to identify the mathematics in their children's activities, as these are rooted in their experiences of schooling (Grenfell & James, 1998). Habitus includes a sense of parents' place in a social situation and the status they bring, such as how comfortable they feel in an interview and their views about what is expected of them to say or do.

The data in my study

Using Bourdieu's notions, I discuss the advantages and disadvantages of photo elicitation interviews by using examples from my study of nine Norwegian parents' (4 males, 5 females) views on mathematics activities their children engage in at home. This is a typical sample size for photo-elicited research involving both the production of visual data (photos) and participants' discussions and reflections of the photos (e.g., Clark-Ibáñez, 2004; Miller, 2015). Participants received guidelines in a letter about what to photograph (children engaged in mathematics), how many photos to take (10), time to complete this task (one week) and where to send the photos after completing the task. No data that could identify participants, such as income, education and family structure, and demographic details, were collected. The parents were asked to attend focus group interviews in which some of the photographs were used as stimuli. In group one, there were four parents, in group two five. During the interviews, the parents used their photo and those of others as a basis for sharing their views about children's mathematics activities.

In reflecting on my use of PEI, I was able to identify both advantages and disadvantages associated with gaining an insider view on parents' understanding about their children's mathematics activities. In the reflection, I also need to consider how my position as the researcher and facilitator of PEI may have affected my understanding. I come from a working-class background, was a preschool teacher in a low-income household area, and am a mother of two children. My research focuses on mathematics education in preschool and at home. These personal characteristics and experiences influence my position in the field and affect my habitus and doxa (organising the rules of PEI in the field of social situation to discuss photos). Reflecting on PEI supports me to understand how my own background can hinder or support me making sense of parents' views.

Discussion

Reflecting on PEI contributed to identifying advantages and disadvantages in generating data from it. In particular, the parents' cultural capital seemed to affect their sharing of views about their children engaging with mathematics.

Disadvantages of PEI

Drawing on Bourdieu's theoretical notion of the field, I could identify some of the parents' available positions which were affected by parents' habitus and dispositions to discuss mathematics activities and the status they brought to the situation. Although earlier research suggested that PEI is an effective strategy to gather data for investigating parents' views, it has some challenges.

PEI requires participants to be provided with more or less detailed instructions about what to photograph. However, the field in which these instructions are given in my study is that of research, a field in which not all participants can determine the implicit rules. For example, the participants

needed to understand how the photos would be used, including ethical, privacy and sampling issues, but this information was not provided. It was clear that their interpretation of these issues shaped how and what they took photos of in their home environments. This sometimes resulted in the parents not being able to describe their views on the mathematics young children could engage in. For example, a parent stated, "I think he shows fingers too, but I did not manage to take a picture to capture that". For a researcher, knowing the context of the discussion stimuli is important. However, like this parent, it did not always occur to the participants to take notes about the circumstances of a photo. This lack of knowledge about the research field affected how much each photo contributed to the discussions. If the parent who had taken the photo could not remember why they had taken it, then it was often difficult to provoke a discussion amongst the other participants. Thus, it seems that I needed to be more aware of the habitus and dispositions that the participants brought to the task.

Although it is stated that PEI offers insights that might not be achieved through verbal-only methods, the usefulness of the data is still dependent on the interviewing skills of the researcher. Within the field of research, the researcher is accepted as being more knowledgeable about how to do the research than participants are. This power dynamic can affect participants' willingness to discuss the topic if I, as the researcher, impose my own view, as occurred in the following example:

Researcher: Is Yahtzee a game that you play a lot in Norway?

Parent 1: It is a (holiday) cottage phenomenon.

Parent 2: Yes, yes, yes!

Researcher: Okay.

Parent 1: Yes, everybody plays Yahtzee.

Parent 2: All Norwegians that have respect for themselves have Yahtzee in their (holiday) cottages.

Researcher: So, you can claim that all children know Yahtzee in Norway?

Parent 2: Yes, I think so. They probably have the same in preschool too.

Researcher: But I mean, do you have it at home?

Parent 2: Yes, it's quite common to have it at home.

Parent 3: Yes, it's a regular game to have a home. Yes!

The rules of PEI used by myself, as the researcher to construct or, as Bourdieu stated, to produce, circulate and exchange knowledge, pushed the conversation in a particular direction through my follow-up questions. Although I was seeking clarification, the parents' responses suggest that the conversation was somewhat awkward as they are not entirely sure what was being clarified and why. The parents' answers suggest that they assumed that I as the researcher would have the same knowledge (cultural capital) about what would occur in holiday cottages, and as this was an experience shared by all Norwegians, it appeared not need elaboration. They seemed confused as to why I continued to question them about the presence of Yahtzee in Norwegian homes. The status they brought was not embedded in my habitus for understanding parents' embodied views.

In the Yahtzee, example parents were placed in a position of having to convince me, which could affect their behaviour in later discussions, hence limiting their possibilities to develop a sense of trust in how I would make sense of the information they were providing. In another example, the angle of the photo of the outdoor game "stone skipping" did not provide an immediately recognisable mathematical situation for myself or other parents.

Parent 4: I think of distance, but I am unsure if this is correct.

Researcher: What are you doing?

Parent 4: My son will throw stones in the lake and has two stones, one in each hand. I do not know if you see here (pointing on the photo). No, you cannot see his hands!

Researcher: What you are thinking about this situation?

Parent 4: I think distance, but he does not. I do not know, maybe how far he should throw the stone?

The lack of response by other parents suggests that they perhaps did not share the social capital hidden in Parent 4's photo, and thus did not "see" the potential mathematics that the child was engaging with. Whereas Parent 4's habitus could be explained as a disposition to act in this activity, for the researcher to see a possible identification of mathematics in "stone skipping" to some degree was uncertain.

As well, differences in social capital between parents and the researcher can interfere with providing recollections about the content of the photo and its social context. For example, after a father spoke about playing an app on a tablet, a mother asked me, as a researcher, for an opinion about children playing apps. That parent seemed to consider that I had a form of cultural capital that gave me the possibility to evaluate the value of another parent's point of view.

In summary, PEIs have some disadvantages, related to how parents' positions are located in the field. As the facilitator of the PEIs, I, as the researcher, had more status and the social capital that I brought with me seemed to be considered more relevant for this research field. This unacknowledged valuing could limit the possibilities for parents' views to be valued appropriately in the discussions. As a researcher, I needed to be aware of how I could overcome these disadvantages.

Advantages of PEI

Bourdieu's notion of field situates parents' positions (knowledge, skills and relationships) in interactions in which their habitus (behaviours and dispositions) is evident. From this notion, I could identify opportunities for gaining insights into parent's views about mathematics activities at home for young children in the PEIs. In my project, 23 coloured photos were used to stimulate discussions. Parents used the photographs to discuss the mathematics they considered their children engaged with. Parents' positions were constituted by the system of the relationships they had to each other as parents and having an interest in discussing and presenting their views on children's mathematics activities at home.

Sharing photos engaged parents in discussions about their children engaging in a variety of mathematics situations at home (e.g., gaming, cooking, playing, building etc.). Some situations, such as playing the board games Ludo or Yahtzee, were recognized in the photos by many parents, suggesting that they shared social capital that allowed them to relate to these activities. This then

allowed them to share their understanding about their family resources to describe different strategies the family used to play these games with children. Within the social field of the group interview context, there were possibilities to uncover what parents had in common as the first educators of young children. The similar strategies for supporting children in the games, such as manipulating the game so that younger siblings had a chance to win or participate, suggested that the parents could "read" each other's habitus and confirmed each other's views on these situations being mathematical. The parents supported each other in a confident manner when discussing their children's actions, for example, when they were using dice. In the field, there are different positions available for persons with different habitus, and they are equipped with different capitals. Their capitals can be valued differently and also in different ways (Bourdieu, 1975). Bourdieu stated that what is valued is important as what it is, and different ways of being engaged in mathematics at home may also be given different values. This is an example of a condition for being qualified as a capital.

For some parents, the sharing provided them with new ways to think about everyday activities. For example, a parent stated:

> In a busy day at home, it is a bit difficult to think about mathematics, it's not easy at all. You are not thinking about it. But once you are aware of it, you are going to find it, you'll find it all over the place.

From the everyday activities, these parents could identify and discuss mathematics and its possible relevance in home environments. As considered with cultural capital, parents' views about mathematics activities can be gained through PEI and it becomes relevant to reflect on mathematics from their point of view.

The photos taken in environments well known by the parents supported them to express their point of view. The parents' photos had been taken because the parents believed that they showed their children engaging with mathematics, based on their knowledge of what could be labelled mathematical. As parents' participation in PEI includes a system of power relations between positions, the parents seemed to share cultural capital by recognising that they also engaged in similar situations, which meant they were able to take powerful positions as experts within the research field. This was in contrast to situations where PEI did not support the sharing of views – a result of one person, often me as the researcher, being seen as having more valuable knowledge or by acting as though that was the case.

Conclusion

Drawing on Bourdieu's notion of the field to reflect on the impact of using PEIs in early years mathematics research, habitus was a tool for understanding parents' dispositions and had to do with conditions that are set up in the field. The way in which the parents understood the structure of PEI and how this knowledge was incorporated in their habitus was influenced by the new experiences of discussing photos with others. The condition of PEI was structured internally in terms of power relations between parents and researcher and had an impact on gaining insights into parents' views about mathematics activities of young children. Parents views are embedded between structure, their habitus and capitals and are representations of implicit relations that affect what is considered as mathematics activities. In the field of research, parents struggle over the unequal distribution of and

definition of what are the most valued views. Therefore, it is a matter of distinguishing the most worthwhile efforts and methodology where parents' views can be carried out.

A field can be considered as a social arena of the positions available for persons, each person with a different habitus. In a certain field different capitals are valued (Bourdieu, 1975). As a method for gathering data, PEI includes certain kinds of rules which made a limited set of positions available for those who participated in a study. PEIs are described as enabling participants to record and reflect on their own perspectives and concerns, by promoting dialogue about issues and views through discussions about photos (Miller, 2015). When initiating PEI, I had no doubt that parents' dispositions to take an active position in discussion required me to be reflective. As the parents had already identified mathematics activities at home when they decided to take specific photographs, they came into the interviews situated as experts. In the parts of the interviews in which they could situate themselves as experts, parents were able to discuss the different photographs by talking about the mathematics that they saw their children engaged with at home.

However, there were challenges in using PEIs which hindered the parents is retaining the position of expert in those interviews. As a researcher, I was located within the research field, where I organized the rules and guidelines for PEI. Although the formal rules were sent out with the information letter, there were invisible rules connected to the field of research that the parents were unaware of such as keeping notes about the photos they had taken, which affected the data which was produced.

The PEI methodology is a social activity, where parents could contribute with a certain kind of knowledge, based on their capitals and habitus. Parents suggested that taking photos gave them new views on the activities their children engage in at home. They also found the task to be of interest and helpful to unpack their own views about mathematics education for young children at home. As a researcher, reflecting on the use of PEI to gather data has helped me understand how my actions can support or limit parents providing their views about the mathematics that their children engaged with at home. This is important if I am to be able to evaluate my own research questions as well as give information back to the preschool sector about the expertise that parents could have about mathematics activities that could be used as a basis for activities in preschool.

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Chapter 24
Parents' Valuing of Mathematics for Young Children

Dorota Lembrér

24.1 Introduction

In this chapter, parents, as well as other family members, are recognised as young children's first educators who contribute to their learning of mathematics knowledge and skills (Phillipson, Gervasoni, & Sullivan, 2017). From this perspective, parents' views on mathematics education can be considered as assets that influence children's mathematical learning in their early years (Björklund & Pramling, 2017). However, there has been a limited amount of research that has taken parents' views seriously concerning young children's engagement in mathematical learning opportunities at home. In this chapter, I explore the narratives of nine Norwegian parents in order to understand their views on children's mathematics activities at home. From these views, I identify the values they hold about mathematics learning. I am interested in the values that are embedded in (LeFevre, Polyzoi, Skwarchuk, Fast, & Sowinski, 2010)—or emerge through (Aubrey, Bottle, & Godfrey, 2003)—the narratives they tell about the children's informal activities at home, rather than planned and goal-oriented mathematics activities in early childhood education institutions (Björklund, 2014).

Although research studies in mathematics education highlight parents' roles differently in regard to their children's mathematics learning, knowledge and skills, most situate young children as capable of showing adults (parents, teachers and researchers) their understanding of mathematics (Aubrey et al., 2003; Wager & Whyte, 2013). In fulfilling their roles as first educators, parents are considered to be active participants in the construction of their children's mathematics skills, which they interpret in many ways (Hawighorst, 2005). Some research has focused on *why* home environments are important for children's mathematics development and learning (Brenner, 1998). Other studies have sought to understand *how* home

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environments can contribute to children's school mathematics learning (Civil, Guevara, & Allexsaht-Snider, 2002). For example, Clarke and Robbins (2004) showed that parents were aware of the mathematics in everyday experiences that children engaged in at home, such as measuring ingredients for cooking. As a result of these studies, parents are often encouraged to use everyday experiences as tools to develop mathematical skills and knowledge with their children (Anderson & Anderson, 2018). When children attend preschool,[1] they bring with them experiences from outside the preschool that can form the basis for mathematical activities (Clarke & Robbins, 2004).

However, parents' views about mathematics activities that their children engage in at home may be different from those of teachers, but are important if children's transition to preschool is to be supported. Therefore, the focus of this study is on how parents describe their children's engagement with mathematics at home and the research question is: what do parents value in the mathematics activities that their children engage in at home?

24.2 Theoretical Perspective

In this study, parents' views about children's mathematics activities at home are investigated in photo-elicitated interviews (PEIs). In these interviews, the parents used narratives to reflect on the photos they took of their children engaging with mathematics at home. I consider parents' narratives to be socially constructed (Burton, 1996), in that they are formed by wider societal understandings of these specific situations. In an earlier study, I investigated the perspectives of Polish immigrant parents living in Sweden in regard to the mathematics that their children experienced in preschool (Lembrér, 2018). The findings suggested that the Polish parents had adopted Swedish societal norms and values about mathematics in preschools.

A narrative approach to research is a way of understanding how meaning is imposed on experiences (Burton, 1996, 1999). As Sfard and Prusak (2005) stated, the narratives are told by an author, about a person, to a listener: 'By foregrounding the "person's own narrativizations" and 'telling who one is", they link the notion of identity to the activity of communication, conceived broadly as including self-dialogue—that is, thinking' (Sfard & Prusak, 2005, p. 16).

[1] I adopt the word 'preschool' as a label for institutions for Early Childhood Education and Care (ECEC) in Norway, for 1–5 year-old children.

24.2.1 Narrative Approach to the Learning of Mathematics

For this study, there was a need for a framework for analysing parents' narratives in order to identify the values they held about the mathematics activities their children engaged in at home. Consequently, I adapted the narrative framework of Burton (1996, 1999). In work with children, Burton (1999) described a mathematical narrative as something that 'may be told and re-told in the style and with emphasis chosen by the agent(s) who author(s) the telling' (p. 24). Burton's (1996) narrative approach was designed to unpack students' learning of mathematics by interpreting their actions and interactions with others as narratives. The narrative approach provided insights into the children's understanding of the learning process. Burton (1996) stated that, 'with respect to the content of mathematics, instead of presenting it as "objective", independent and fixed, we can tell its socio-cultural story, seeing it as a solution to a social imperative of a particular culture' (p. 32).

Burton (2002) saw narratives, formed from the children's actions when doing mathematics, as having four aspects: authoring, sense-making, collaborating, and using non-verbal narratives. Authoring is when a person uses their experiences to reflect on and generate views about learning mathematics. Burton described authoring as a way of structuring the children's coming-to-know mathematics process. Burton (2002) gave an example of a boy counting from 1 to 11, 12 before jumping to 31, because he seemed to misread 13. He continued to count until he reached thirty ten and thirty twelve. Burton described the child as authoring his mathematical knowledge about counting beyond 10.

Burton indicated that by looking for differences between what the children did and how mathematics was taught, teachers (and other adults, including researchers) created possibilities for investigating the children's sense-making, which in this case was about counting. Burton suggested that this narrative gave information about the child's mathematical development, in that having learnt to count from 1 to 10, the boy then created a system to extend and use this pattern with larger numbers.

Burton (2002) exemplified the collaborating aspect by describing how one child used some of another child's response to explore number constructions together. The example came from a lesson when a teacher asked the children to state the biggest number they knew. One boy gave the response 252 thousand million, two thousand and, after a comment from the teacher, then changed his response to 252 thousand million. Another boy used this to suggest 252 and 20 million trillion as the biggest number, which was followed by the first boy saying 252 thousand million trillion. Burton classified this as collaborating, as the children played imaginatively with numbers by using each other's ideas.

An example of non-verbal communication was, 'Katy's partner asked her to make the calculator display 230. The constant had been set to +10. She approached this problem by stopping on 30 and staring at it, then stopping on 130 and commenting that there needed to be a 2 at the front before finally stopping on the correct symbolization' (Burton, 2002, p. 9). Katy used non-verbal communication when

using the calculator and verbal communication to describe what the calculator was showing.

Burton recognised that people's actions and interactions provided information about mathematics, or what mathematics was about, what it could be and what it should be used for. Thus, she considered that narratives connect the social and the personal by showing how the social environment influences individuals' views of what it means to learn mathematics.

> Narrative is *a*, possibly *the*, way to explore the meaning of experience, narrating is participatory, involving a community in telling and responding to a story. Narrative starts from the personal and the particular, often encountering the general in its journey, and returns to the personal again. Narrative is a strategy for seeking possible answers to questions about our world. (Burton, 1996, p. 30).

Burton's (1996) narrative approach concentrates on the construction of personally meaningful mathematics, in which mathematics is viewed as a sociocultural artefact. Burton (1999) considered mathematics learning to be a narrative process in which mathematics knowledge and skills are validated by the adults, particularly teachers. She noted how this approach opened up possibilities for personal narratives to enhance and enrich children's possibilities to learn mathematics.

Burton (1999) identified two kinds of narratives that support people's understanding of mathematics and the learning processes. She stated that a paradigmatic narrative seeks 'to establish generalities out of particular examples' (p. 21) while an imaginative narrative is 'attempting to tell engaging and believable stories which become exemplifications' (p. 21). These two kinds of narratives impose coherent meanings on individual experiences and 'are personal in the degree to which they reflect a particular journey towards knowing, general (paradigmatic) where they develop mathematical generalities, that is where they turn from being imaginative to becoming recognizably paradigmatic knowledge' (p. 31).

For this study, I have adapted Burton's (1996, 1999) narrative approach to learning mathematics in order to identify, in the parents' discussions, the sets of values they hold about young children's mathematics learning at home. In the next section, I describe how Burton's (2002) four aspects of narratives are adapted for examining parents' narratives about their children engaging in mathematical activities at home and how this led to identifying insights into their values about mathematics learning in these activities.

24.3 Methodology

To gain parents' narratives, photo-elicitated interviews (PEIs) were used. In photo-elicitated interviews (PEI), participants are asked to take photos of a topic or issue and these photos are then used to gain personal views and to allow participants to influence the direction of the interview (Greenbaum, 1999). This methodology is considered more effective in gaining insider views, than information from

exclusively verbal methods (Hurworth, 2004). PEIs can facilitate dialogues by engaging participants and are seen as enjoyable because participants can express their views and experiences (Torre & Murphy, 2015). The photos support participants to reflect on a moment or an action.

In the PEIs in this study, a set of photos taken by the parents were used to enhance collaborative and participatory data collection. The narratives were not in the photos, but emerged in parents' discussions as they talked together about the photos. The parents' narratives imposed meaning on their experiences about their children's engagement with mathematics at home and were endorsed or challenged in the discussions with others. By exploring parents' narratives, societal views about mathematics for young children could be identified, providing potential nuances to the views of teachers and policymakers.

Data were collected from nine Norwegian parents, after contact was made with preschool staff about the project. The parents received a letter asking them to participate in the study. The parents were made aware that they could withdraw from the study at any time and that all data would be anonymised. Those parents who agreed to participate received guidelines about photographing their children engaging in mathematical activities at home. No information was provided about what a mathematics activity was and it was left to the parents to decide what to photograph.

Each family sent 5–17 photos, taken during 1 week in May 2017. In June 2017, I conducted two PEIs, with five and four parents, respectively. To keep the interview to a reasonable length, a restricted number of photos were chosen. Choosing the photos was done by categorising the photos according to Bishop's (1988) six mathematical activities (playing, explaining, designing, locating, measuring and counting). Bishop's six activities allowed us to identify examples of different kinds of mathematics in these photos. Inspiration for categorising the photos was taken from the work of Hauge et al. (2018), who classified participants' photos using Bishop's (1988) six activities, by identifying the principal activity that the children were engaged in. A similar classification was done with the set of photos contributed by the parents, in collaboration with two other researchers who were part of the wider study (see Fosse, Lange & Meaney in this book). At least one photo representing each of Bishop's mathematical activities and at least one photo from each parent was chosen for each interview. However, it was not presumed that the participants would 'see' the same mathematics in the photographs as the researchers. Instead, the choice of photos was intended to provide parents with a range of possibilities to describe mathematics for young children. As this study is guided by a narrative approach, children engaging in mathematics activities at home were viewed from the perspective of the parents. It was their views and understanding of children's actions in these activities which were in focus.

For the two PEIs, 9 and 14 photos were chosen, respectively. In the PEIs, I initiated the discussions about each photo by asking: (1) Can you describe the story behind this photo? (2) What kinds of mathematics do you see your child doing in this photo? The PEIs lasted 55 min, and 1 h and 15 min, respectively, and were audio and video recorded. The parents are referred to as P1–P9, and in the case

where both parents of one child were represented, they are referred to as P6a and P6b. The PEIs were transcribed, with some editing for clarity.

24.3.1 Analysis of the Data

The initial analysis began with identifying descriptions of mathematics. In this way, groups of similar activities were identified in the transcripts. These were: board games, counting, measuring, and using money. I then searched these groups for Burton's four aspects of narratives (see Table 24.1). I repeated this search twice to ensure that all aspects were identified. To identify the kinds of values the parents held about the mathematics learning of their children in home situations, I analysed the data by asking to what extent and in what way:

(a) parents used experiences to reflect on and generate their views about mathematics in children's activities (authoring)
(b) parents made sense of how their children engaged in mathematics activities, (sense-making)
(c) parents endorsed shared engagement and validated each other's views about what constitute mathematics in the activities (collaborating)

Table 24.1 The four aspects of narratives adapted from Burton, used to explore parents' views about mathematics activities of young children

Four aspects of narratives	Aspect about learning of mathematics identified in children's narratives	Aspect about learning of mathematics identified in parents' narratives
Authoring	Children's expressions and descriptions of mathematics in a particular activity/context	Parents' expressions and descriptions of how their children engaged with mathematics at home
Sense-making	Sense-making is about reflection of a particular journey towards certain mathematics knowledge and skills	Parents' views on how their children made sense of the mathematics they engaged with during an activity at home
Collaborating	Collaborating includes validating children's and other's reasoning and use of artefacts that encourage sharing amongst participants	Parents co-creating their understandings about their engagement with their children and by children engaging with each other and the use of artefacts that encourage sharing amongst family members
Non-verbal communication	This form of communication provides information about how children use artefacts to complement their verbal narratives about learning in mathematics It focuses on the non-verbal actions and children's use of artefacts	This is about how parents viewed their own and their children's use of artefacts or tools in mathematics activities at home It focuses on parents' view on the children's non-verbal actions and use of artefacts

(d) parents reflected on the artefacts their children engaged with when doing mathematical activities (non-verbal communication)

Table 24.1 describes the four aspects of narratives identified by Burton in children's narratives, and the adaptations I made to identify the values that the parents held about the mathematics their children did at home.

In the next section, I present the results from parents' narratives about young children's engagement in mathematics activities at home. From this analysis, I identify the components of mathematical activities for young children that the parents seemed to value the most.

24.4 Results

In this section, I present four groups of activities that emerged from the empirical data of two PEIs with parents. Each of the groups (board games, counting, measuring, and using money) is discussed in relation to the four aspects of narratives, and the parents' values about mathematics for young children.

24.4.1 Yahtzee and Ludo, the Value of Learning Numbers

The parents described their children playing the board games Yahtzee and Ludo in both PEIs. A photo of children playing Yahtzee was used as a stimulus for discussion in the first PEI group and a photo of children playing Ludo was discussed in the second PEI. The parents' narratives about board games indicated that they valued their children learning numbers, in addition to the use of particular pedagogical approaches for supporting their children to do this through playing Yahtzee and Ludo.

All the parents stated that these games were available at home or in holiday cottages. For example, P6b stated 'Ludo and Yahtzee were board games that were probably present in most homes'. One of the parents (P3) described that their children did not play Yahtzee at home and reflected over this:

> I have got a little guilty conscience, because we almost never played Yahtzee with our other child. So we must go home and do that.

In this example, P3 indicated that it was other parents' stories that made them reflect on the potential for mathematics learning when playing Yahtzee. This example showed how societal views, through the narratives of other parents, came to influence an individual's view on these kinds of activities. Although this explicit acknowledgement of the influence of others was not made again, it was clear that the social interaction in the PEI between the parents provided a possibility to

collaborate in enlarging what was seen as possibilities for children to learn mathematics at home.

The parents' narratives suggested that there was potential for the children to engage in counting, adding and subtracting and, to a lesser extent, multiplying, when playing the board games. The parents considered that the children authored experiences about their coming to know number names and counting sequences. P8 provided a typical narrative about their child:

> We are playing Yahtzee with him (their younger son) in order to collect all the sixes, but it's also worth gathering all the sixes. We want to have six on the die because when playing Ludo we count how many dots there are on the die. We practice that with him, because he counts incorrectly. He could not count them, but he saw that there were six. He has just begun, so here we are a little patient with him.

The parents' valuing of learning numbers can be seen in the recognition that their child could not count to six so they used Ludo as a way of encouraging the child to count with them. This can be seen in the statements about 'gathering all the sixes' in order to follow the rules, 'we want to have six on the die'. P8 supported their child in noticing that there were six dots on a die, to learn a number word and to connect it to a specific quantity. In doing this, P8 showed that they also valued the collaboration and the sharing of experience as important in supporting the child's learning to count.

Other parents' narratives provided more detailed descriptions about the mathematics learning that children could gain from playing these games.

P5	It's good practice to add and subtract, to understand the relationships between numbers
P2	When you have four dice with five dots on each one, it will be four multiplied by five. But he takes all five dice and can really add up all the dice. He does that only because he has played a lot

In the last narrative, P2 reflected on how there was a possibility for the child to engage in multiplying, even though the child only used addition. This is an example of sense-making in that the parent identified how their child used addition, but could move towards using multiplication. Although P2 highlighted that the child could work out the amount on the dice, they also indicated that they saw understanding multiplication as being important for children. In P2's narrative, the child's learning is described as going from the particular context of multiplication and addition to their own experiences.

The parents' valuing of learning numbers seemed to lead them to facilitate their children playing Yahtzee. By collaborating through endorsing each other's experiences, the parents described their pedagogical decisions about providing opportunities for repeating the numbers and making connections to addition. As was the case in the other narratives, P5 explained how they used dice as artefacts to engage their young child in Yahtzee:

> We play with a die with the numbers 1 to 6, but with the younger child we use the die with dots. It is a little easier then.

In this narrative, the parent described their pedagogical choice about which representation of amounts on the die was needed so that their younger child could play Yahtzee. P5 situated their children's mathematics knowledge as not yet sufficient, in that P5's child could not yet recognise numerals. To support the children in learning the valued knowledge of counting, P5 made choices about the artefacts the children could engage with.

The child's use of dice to show their counting competence was an example of the non-verbal communication aspect of narratives and provided information about what the child was capable of doing. In another narrative, P8 stated that they played Ludo frequently and because their oldest son had learned to count very well, they now played with two dice. However, the additions that the child did were connected to the specific context of the mathematical activity:

> In other situations, I cannot say to him, 'What's 5 + 6', but when we play Ludo and he throws five and six then he knows that it is 11.

Like P5, P8 also recognised what their child could do and provided two dice to extend the child's mathematical understandings.

The parents' narratives showed that they valued their children learning numbers when playing board games and this valuing prompted the parents to seek out opportunities for the children to learn to count at home. If children are throwing a die as part of a game, then the question of 'how many dots are there' can be asked. A similar focus on the knowledge and skills linked to numbers was also found by LeFevre et al. (2010). In LeFevre's et al.'s study, the parents observed and paid attention to the numeracy activities that were linked to children's knowledge about counting sequences, with activities such as board games being related to learning numbers. However, in the Norwegian parents' narratives, there seemed to be a distinction between the value of learning numbers and the value of learning counting skills, as discussed in next section. The narratives about how children learned to count by themselves or in activities with family members did not include the parents describing their own engagement and pedagogical choices explicitly.

24.4.2 Everyday Activities, the Value of Learning Counting Skills

Several of the photos used in the PEIs showed children engaging in everyday activities, such as watching TV, eating, reading and free play. As was the case with the board games, in describing the photos in both the PEIs, the parents often focused on their children's development of counting skills, such as repeating number words and labelling specific quantities with the number words. The parents narrated how and in what sense children were encouraged to think of the world in terms of numbers and how they often spontaneously recognised numbers. The parents seemed to value counting strategies and understandings of cardinality.

The following examples of narratives illustrate the everyday activities that the parents saw as being connected to counting skills:

> Olle is watching TV, and they are counting. (P6a)
> He counts 1 and 2 because he is ready, and 3 (and he jumps in the water). (P7)
> He counts screws; he has a lot of them, and he counts those screws. He understands it. (P8)
> She has a book, this book tells counting sequences 1, 2, 3. […] She would count the objects and match them with a numeral on the screen. (P1)

In these narratives, parents described how their children authored their experiences as part of their sense making about learning to count. In making sense of their children's learning, the parents showed their understanding of the complexity of knowing how to count. For example, P7 stated that their 2-year-old child often had a toy in each hand:

> Two things—he tends to have one thing in each hand because he has two hands. For example, two cars. But, here there's not much counting on his part.

P7 viewed this activity as an introduction to the idea that one hand could represent one object. This was valued because it was seen as a beginning stage in developing counting skills.

Other narratives indicated that some parents valued their children learning one-to-one correspondence, in that a number name was connected to touching an object. P6a and P6b reflected on an activity that their son did frequently on his own in the family bathroom.

P6a	He is very keen on counting. He cannot count correctly, but counts 2, 4, 7, 8, 9, 10
P6b	1, 2, 4, 6, 7, 8, I think that's how he counts
P6a	He takes toilet paper rolls on and off again and counts. 'Many rolls!' So he has started to get a little interested in counting
P6b	He has found the most out of it himself. For usually children say '1, 2, 4', but he skips 3 and goes '1, 2, 4'. I do not know exactly how he's gotten into it; the toilet paper rolls are quite easy to move around, and he's able to place them on the toilet paper holder over and over again
P6a	He can count almost to 10, but he does not say all the numbers, so it's not a correct order, he's skipping some
P6b	He just practices saying counting words. Thus, it seems that he only practices in a way. He develops his language; I believe that's part of it

The parents seemed to indicate that touching each object and saying a numeral name aloud was a necessary step towards their child learning to place the correct number words into a counting sequence. This suggested that the parents valued counting but recognised that learning to count was made up of a number of different stages, each of which was important.

As had been the case with playing Ludo and Yahtzee, these narratives showed that the parents noticed that their children were counting. However, their interaction with their children in these activities was not discussed. This suggested that sometimes they chose to just watch and allow their children to explore counting in

their own way. The manipulation of artefacts by the children was more prominent in the parents' narratives and seemed to act as an encouragement for the children to engage in activities by themselves. The parents paid attention to this use of non-verbal communication.

When the parents did mention that they interacted with their children, they seemed to situate themselves as supportive partners, who asked questions or provided opportunities to show that the last number said represented the total number of objects. P6b provided an example where his child asked the question 'how many', and to which the parent asked the child to find another set of objects which had a total of four items.

P6b	He often asks, 'How many fingers is 4?' He likes to count. I ask him what else 4 is, can you find something that is 4 of? We count together when he gets the wrong number of items and needs to add or subtract 1

These narratives are classified as illustrating collaboration between the parent and the child, in which the parent seemed aware that counting was related to the addition and subtraction of 1. Everyday activities also seem to provide opportunities for the children to learn about addition. For example:

P6b	He learns in many situations, such as when we sit down and eat waffles (the waffles can be divided into five pieces, each piece having the shape of a heart). We split the waffle and he has 3 + 2 pieces. Then he splits a 2-piece into 1 + 1, so it is 3 + 1 + 1. He has variants. So 3 + 1 + 1 and 3 + 2 is 5. We do a lot of mathematics everyday, rather randomly

P6b seemed to value the child's opportunity to visualise the decomposing of five in different ways and how this could contribute to the child developing their understanding of addition. This parent seemed to consider this kind of activity to be meaningful for their child.

P8 gave an example of the non-verbal communication aspect of narratives in relation to being able to recognise and write numerical symbols as important components for learning addition.

P8	At his age (their son is 5 years old) you are able to do mathematics when it is visual, if I would write 6 + 6 and ask him, 'How much is it,' I believe he would understand it

In this narrative, the symbolic mathematics was something that this parent considered would communicate meaning to the child and was something that a child would need to learn.

The parents highlighted the value of learning counting skills in everyday activities which their children were often engaged in by themselves. In these activities, the parents did not highlight collaborating with the children, as had been the case with playing board games. Other studies, such as by Aubrey et al. (2003), identified

everyday activities and experiences of young children, initiated by both children themselves and by adults, as potential opportunities for mathematics learning. However, the Norwegian parents saw that everyday activities such as watching TV, eating, reading and free play did not always require them to facilitate their children's learning of counting. Although Aubrey et al. (2003) stated that it was difficult to know how parents' engagement or pedagogical knowledge about stages of learning counting influenced their children's counting skills development, the Norwegian parents showed that they understood that children needed to learn a range of different types of knowledge and skills in order for them to learn to count or do basic operations such as addition.

24.4.3 Length, Volume, Time, and the Value of Learning Measurement Skills

Like the counting activities, activities in which children were measuring items at home appeared frequently in the narratives. Parents highlighted that their children needed to become aware of the attributes of objects that were to be measured, with or without measuring tools. However, the parents also described the difficulties that children might have when learning about measurement.

P8	You cannot expect children to understand strategies in measuring

As was the case for learning to count, this view seemed to contribute to parents emphasising the need to support their children in developing specific, developmental, measuring skills. As such, the authoring of their children's experiences of learning measurement skills often included a reflection on the complexity of the learning process.

P4 stated in a narrative that children needed a lot of practical experiences to estimate quantities. They reflected on a shared experience with their child about determining how much food a fish needed. P4 said that the measuring was not about weight because at this point their son could not measure in grams. Instead, the child simply compared the size of the fish and the amount of food he had in his hand to determine if it was sufficient. P4 explained that the child had said, 'Mum, this fish is quite small so he cannot get so much food'. In this narrative, the parent indicated that the child had identified that it was the amount of food, volume rather than weight, which was important. In doing so, they highlighted that the measuring process required an understanding that an object has attributes that can be measured and that there was a need to determine which attribute was most important in a specific situation. However, using standardised units was not considered essential as P4 described how the child used the measurement term 'small' and compared the fish with food, without using standardised measuring units.

The correct language for naming each unit was highlighted in the narratives about when children compared objects to determine which was longer or shorter or which was heavier or lighter. This suggested that the use of correct terms was valued by the parents.

P5	It is the same with height as well. When he (her son) comes with the yardstick and measures my height, he will say, 'You are sixty high'. But he does not understand what it means, so we can talk about it
	He is reading the numerals on the yardstick and can recognise the numeral 70
P5 told a story about an activity in which their son found objects that had a length of 70 cm:	
He goes around finding objects and comparing their length to the yardstick and then reports back to me that he found something that is 70 long	

In this narrative, the child identified objects that had a specific length by measuring with standard units, using a yardstick as a measuring tool. The parents authored narratives about children exploring the use of standardised units and direct and indirect comparisons. The parents used these narratives to make sense of what their children understood about the measuring process. The parents seemed to value the children exploring objects and their attributes as part of their learning. The collaborating and shared engagement, where children needed to use descriptive language, also seemed to be valued.

Measuring time was debated by the parents, especially in regard to whether young children could learn to read a clock. Parents seemed to agree that young children could not measure time precisely. Instead, reading a clock was a skill that was learned in progressive steps over time. Some parents indicated that an initial step was for children to show an interest in learning to tell time. Standard units of measurement, such as hours, seconds and minutes, were often introduced by the parents. For example, P5 explained how they helped their children make sense of a minute, by timing how long they took to brush their teeth.

> I try to explain a particular timeslot of 60 seconds, so I told my children that it takes 60 seconds to brush their teeth. So we can talk a little about the clock and how long one minutes takes.

The different aspects of learning mathematics, as exemplified by parents in this study is similar to what Meaney (2011) found in her study of a 6-year-old child engaged in a number of measurement activities at home. In Meaney's study, the parent understood and recognised that measuring time was a complex concept. Meaney suggested that the abstract nature of time is difficult to grasp, so there is a need to find ways to talk about it (for example, experiencing the timeslot of 60 s when brushing teeth). The Norwegian parents valued that the children need to want to know about learning time as the first stage, which is different from Meaney's study where the mother recognises a need to learn how to tell time for practical reasons.

Parents valued mathematics activities that drew children's attention to the attributes of objects and highlighted the descriptive language and comparison terms that are important for describing these attributes. This suggests that the parents valued

the children's sense-making as they began to measure objects and their strategies for learning how to measure. There are some similarities to Clarke and Robbins (2004) in which children measuring ingredients and cooking at home were identified as illustrating measuring capabilities. According to these researchers, these kinds of activities offered general mathematical experiences for the children, while the narratives from the Norwegian parents gave more detailed justifications about learning measurement skills. The parents not only recognised opportunities for exploring attributes of objects or use of standardised measuring units but also valued the development stages of learning measurement skills when children engaged in activities such as feeding a fish.

24.4.4 Money and the Valuing of Equivalence

The last group of activities were to do with the equivalence of money, particularly between notes and coins. In both PEIs groups, there were photos in which children engaged with money, such as when they were saving for a toy or receiving money as a gift. The parents seemed to value their children understanding the equivalence of different representations of money as a prerequisite for children learning how to spend their money wisely. In the parents' narratives, there was evidence for valuing of this skill as something important and useful for children to develop the ability to use money in everyday circumstances. This is also validated in the work by Brenner (1998), where she found that activities with money, buying things or spending money, are among children's most common uses of mathematics outside of school. To gain this skill, parents indicated that they needed to collaborate with their children by using artefacts, such as money or objects. The parents authored narratives about how children came to know how to use money in everyday life.

One parent described going to a recycling centre and trying to help her child understand the value of the money gained from recycling a specific amount of cans by comparing it to an amount of Lego.

P3	The aim of going to the recycling centre with my son is to talk about the value of things. I explain to him how many bags of cans we need to recycle in order to have money to buy a small Lego set. So instead of talking a lot about numbers, I compare the number of bags we need to recycle to save for Legos. I am not good at it, but I try to help him relate to it

P3 considered that numbers alone would not help their child understand equivalence. Instead, P3 highlighted the need to make comparisons that made sense to the child. They supported the child in seeing the equivalence between a number of bags of cans that needed to be recycled and how much was needed to buy a Lego set. Yet, in the narrative, P3 highlighted their lack of pedagogical knowledge about explaining to their child the value of what was being recycled.

There were several other narratives in which the parents explained how their children did not recognise the value of notes, demanding to have coins instead because they were seen as more valuable.

P7	A 100 kroner note is 100 coins, and 10 coins with a value of 10 kroner are also 100 kroner. But my child would rather have 10 (lots) of 10 kroner coins than one 100 kroner note
P1	I can see that she has no understanding of how much 200 kroner is worth even when I would count 1, 2, and 3. She recognises the 50 kroner note, but she has little understanding about the value of 50 NOK, and she would rather have five 10 kroner coins. In terms of notes, she does not yet have an understanding
	My children got 200 kroner each from my mother, but the money was divided differently. I tried to explain to my older child that they both had the same 200 kroner, but she wanted to have more coins. So I decided to exchange her notes for coins. They were preoccupied with having equivalent amounts (volume) of money, not the value of the coins and notes

The parents' narratives seemed to highlight that they valued their children gaining an understanding of the equivalence of notes and coins so that their children could use banknotes in real-world exchanges. As such, the non-verbal communication aspect of the narratives illustrated the children's difficulty in valuing different coins and notes in any other way than simply counting them. These examples illustrated that the parents valued coming to know how to use money but realised that this was a difficult concept for young children to grasp, because of the need to understand the abstract value attached to notes and coins. The parents valued the everyday activities in which children engaged in experiences with money. This was also the case in the Clarke and Robbins (2004) study where shopping situations provided opportunities for parents to use examples of spending money to convey moral learning about not being able to buy everything children wanted to have. The Norwegian parents' narratives suggested that they valued the learning equivalence of money and considered the children's use of artefacts as important in developing this skill.

24.5 Discussion

In this chapter, I have investigated what parents valued in the mathematics activities that their children engaged in at home. These findings contribute to the research stating that parents and families play a role in children's learning and development (Phillipson et al., 2017), but provide a detailed justification for identifying the ways in which parents valued the mathematics activities their children engaged in at home. In considering parents' role as children's first educators, it was important to identify what they understood from their perspective. Yet, at the same time, it was clear that the parents' understanding did not arise in a vacuum, as it was through the discussion with others that their views were endorsed or challenged. In this way, the parents revealed some of the societal norms about mathematics for young children that they accepted. Through the narratives, these parents seemed to agree on the societal values of mathematics education for young children. As had been the case with the Polish parents (Lembrér, 2018), these values were affected by the wider views, but in this study, it was possible to see how the discussions endorsed particular norms and values through their discussions.

By analysing the authoring, sense-making, collaborating and non-verbal communicating aspects of Burton's (1999) narrative approach, the parents' values became apparent to do with: learning numbers, counting and measurement skills, and the use of money in everyday life. The parents also indicated that they valued activities which supported the children at their different developmental stages.

The parents authored narratives in which they indicated that they were aware of how their children engaged with mathematics learning at home by identifying a variety of knowledge and actions that their children could currently do and what they would like them to be able to do in the future. For example, they recognised that their children had a range of different counting skills but were not yet able to do multiplication or recognise the equivalence of coins and notes.

As the activities were undertaken both by the children themselves and with family members, the parents were able to discuss when and why they would interact with their children during the activity as the collaborating aspect of the narratives. They also collectively explored their role in their children's mathematics learning and its impact on how their children were engaging with mathematics. The parents discussed their pedagogical skills, used different methods to support their children when engaging in mathematics activities, and were aware of what their children could potentially learn in a specific situation. For some parents, playing board games allowed them to identify a range of mathematics skills that were part of the children's everyday experiences.

In regard to the non-verbal aspect of narratives, the parents showed awareness of how artefacts, such as dice and measuring tools, could be used to support children's engagement with particular mathematical ideas. They indicated that they understood that some artefacts, such as money, required the children to understand abstract ideas that were too advanced for them. Mathematical symbols were seen by one parent as possibly being understood by their child, but parents of other, younger children might have seen this as being too advanced. This suggests that the parents were able to identify what artefacts would help children to make sense of different mathematical ideas. The parents negotiated their own understandings of children's actions as something valuable in terms of mathematics learning. This confirms what Anderson and Anderson (2018) stated, that parents see children's home experiences as an important source for mathematics learning.

24.6 Conclusion

As parents are children's first educators, it is important to understand what parents value in young children engaging in mathematics activities at home. To do this, I used a narrative approach to identify the ways in which parents' views reveal what they value about doing mathematics at home. In particular, I argue that mathematics learning is something that emerges between parents and children at home, building on the pedagogical choices made by parents. For example, depending on the rules applied by the parents in board games, the children can be supported in different

ways, creating opportunities of development of basic numerical skills. Parents also recognised and valued some unexpected aspects of children's engagement in mathematics activities at home. This provides an opportunity for learning between parents and teachers of young children to become a two way-street with knowledge going between both groups. In earlier research (Whyte & Karabon, 2016), communication has often been situated as a one-way street with parents being told what is important by teachers. Parents' experiences of, and their focus, on children's actions could be considered as potential resources and an example of partnership for shared responsibilities in education between preschool staff and parents (Hujala, Turja, Gaspar, Veisson, & Waniganayake, 2009).

This research continues to expand early mathematics research with evidence for, and understanding of, young children's expressions to learn mathematics, and to widen our perspectives about providing children with rich, meaningful mathematics learning experiences. Although this study confirms findings from other studies in early childhood mathematics, the nine Norwegian parents provided detailed and more nuanced information about the mathematics learning they valued in young children's activities at home. They highlighted how the authoring of children's mathematics skills by engaging in concrete experiences contributed to sense-making, as well as how they promoted dialogues to help their children make use of artefacts.

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Parents and teachers negotiating truth statements about mathematics education for young children

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Declarations

Not applicable