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“They’d floor you, they really would...they are capable of learning anything” - Irish preschool practitioners’ self-reported practices on young children learning mathematics

Abstract

With increasing focus on STEM (DES, 2017) and mathematics education (DES, 2011) in early childhood, this paper reports on the findings of a qualitative study that explored the beliefs and practices of eight early childhood educators in relation to mathematics in preschool settings. Findings show that while participants held positive attitudes towards mathematics in preschool education, they focused on a narrow range of mathematical concepts: counting, shapes and measures. This study recommends that training in early childhood mathematics be made available to all early childhood educators and suggests that a larger study of mathematical activity in preschool settings be conducted.

Introduction

Preschool mathematics has become a prominent focus for discussion both in research literature and in national and international educational policy contexts over the last decade. Against this backdrop of increasing emphasis on mathematics in early childhood contexts, this study reports on an exploration of the beliefs and practices of eight Irish early childhood practitioners in relation to mathematics education in early childhood (preschool) classrooms. This research contributes an Irish perspective to the growing body of international research on the beliefs and practices of early childhood educators towards mathematics.

Policy Context

Internationally, governments are placing increasing emphasis on Science, Technology, Engineering and Mathematics (STEM) education (Murphy et al., 2019). Ireland too has experienced increased interest in STEM education across the continuum of education, from early childhood to adult-learning (DES, 2011; DES, 2017a; DES, 2017b; DES, 2020), affording special importance to mathematics as a key subject underpinning other STEM disciplines (DES, 2017b). Even countries with a traditionally socio-cultural approach to early childhood pedagogy, for example, Norway, Sweden and Germany, are including specific learning goals in relation to mathematics in their early childhood curricula (Norwegian Directorate for Education and Training, 2017; Skolverket, 2018; Benz, 2012).

The National Literacy and Numeracy Strategy (DES, 2011) positions early childhood educators as being one of the most important resources the country has in terms of developing young children's mathematical thinking and exploration, therefore, it is important to explore what practitioners think about the role of mathematics in early childhood practice and their role in developing a child's mathematical thinking and learning in preschool.

The Irish Preschool Context

In 2010, the Early Childhood Care and Education (ECCE) scheme, which provides young children with a year of preschool education before they enter primary school, was introduced. This was extended to two years of preschool education in 2018. Under this scheme, children access 15 hours of preschool education a week. The number of children attending preschool education currently in Ireland is 128,429 (69% of the total number of children attending childcare services) (ECI, 2018). In order to avail of the ECCE scheme, settings must ensure that the lead practitioner in the preschool room holds a minimum of a QQI level 6 qualification in Early Childhood Care and Education (DCEDIY, 2020), equating to a Further Education (FE) diploma. Irish preschool practice includes a variety of curricular approaches, e.g., Montessori, High Scope, Steiner, Naíonraí (Irish-speaking preschool settings) and play-based practice. Of these approaches, both Montessori and High Scope contain specific mathematical activities for young children to engage with. A further stipulation of availing of ECCE scheme funding is ensuring alignment of the chosen curricular approach with *Aistear: The Early Childhood Curriculum Framework* (NCCA, 2009; DES, 2018).

Aistear The Early Childhood Curriculum Framework (NCCA, 2009) is the framework used by Irish early childhood practitioners working with children from birth to six years. It spans both the preschool and primary school educational sectors. Positioned as a unifying framework, it supports the continuation of a playful pedagogy into the early years of primary education (O'Kane, 2016). *Aistear* considers early childhood development and education across four broad themes: Well-being, Identity and Belonging, Communicating, and Exploring and Thinking. Mathematics is explicitly covered in both Communicating and Exploring and Thinking, reflecting the communicative and creative aspects of mathematics. Although some of the learning goals in *Aistear* do not mention mathematics explicitly, they do describe the goals for quality early mathematical activities. For example: justifying, making connections, reasoning, problem-solving, predicting and analysing feature in Exploring and Thinking. *Aistear* also positions adults as being instrumental in helping young children to develop positive dispositions towards learning. Dispositions such as curiosity, persistence, concentration and determination feature in both Well-being and Identity and Belonging (NCCA, 2009). Each theme is

accompanied by a series of sample learning opportunities (SLOs) to support practitioners in supporting children’s learning.

Table 1: The Range of Mathematical Concepts in *Aistear* (NCCA, 2009)

Exploring and Thinking	
Aim	Learning Goal
1. Children will learn about and make sense of the world around them.	<i>In partnership with the adult, children will:</i> 5. develop a sense of time, shape, space and place
	6. come to understand concepts such as matching, comparing, ordering, sorting, size, weight, height, length, capacity and money in an enjoyable and meaningful way.
Communicating	
Aim	Learning Goal
3. Children will broaden their understanding of the world by making sense of experiences through language.	<i>In partnership with the adult, children will:</i> 6. develop counting skills and a growing understanding of the meaning and use of numbers and mathematical language in an enjoyable and meaningful way.

In 2014, the National Council for Curriculum and Assessment (NCCA) commissioned two research reports covering the teaching and learning of mathematics across the 3 -8 age range. These reports view young children as capable and competent mathematicians, who are capable of engaging with broad, challenging mathematical experiences (Dooley et al, 2014; Dunphy et al, 2014). This is also evident in the research context, where studies have shown that babies and young children are born primed to engage with the world in a mathematical way (Geist, 2009). Children build on informal mathematical explorations, devising problem-solving strategies during play (Ginsburg & Seo, 2004) and engaging in problem-solving using numbers (Sarama & Clements, 2009). The NCCA (2014) research reports acknowledge that young children experience mathematical activity from birth, initially in the home environment, then in preschool settings, bringing this mathematical knowledge with them to infant classes of primary schools. While these reports highlight the contribution that preschools make to children’s mathematical learning, it is worth emphasising that current research in early childhood mathematics still advocates a playful pedagogy (Dooley et al, 2014; Cohrsen, Tayler & Cloney, 2015).

Beliefs

How early childhood educators feel or believe about incorporating mathematics in their classrooms can impact the learning experiences that children receive. Educator beliefs are identified as a critical

component of 'teacher competence' in conjunction with subject content knowledge and pedagogical content knowledge (Dunekacke, Jenßen, Eilerts and Blömeke, 2016). Despite having been identified as an important factor of 'teacher competence', there is a lack of research generally exploring the beliefs of preschool educators towards mathematics in preschool (Sumpter, 2019). Little research has been carried out in the Irish context (Dunphy, 2017).

Kagan (1992) defines educator beliefs as, 'tacit, often unconsciously held assumptions about students, classrooms, and the academic material to be taught' (p.65). Beliefs can influence pedagogical practice (Chen et al., 2014; Fives & Beuhl, 2016), impact on daily decisions (Anders & Rossbach, 2015), affect curriculum implementation (Platas, 2015), and may also impinge on a practitioner's ability to see mathematical concepts in children's play (Oppermann et al., 2016). Benz (2012) notes that beliefs impact the incorporation of mathematics in early childhood settings generally. Similar findings by Anders & Rossbach (2015) in their study of 221 German preschool teachers demonstrated that educators' sensitivity to mathematics in children's activity was strongly influenced by their attitudes towards mathematics.

In the Irish context, where the national curriculum framework, *Aistear* (NCCA, 2009), states very broad learning goals for mathematics, beliefs towards mathematics can influence whether all of these concepts are explored in a real and meaningful way in preschool settings.

Beliefs about intentional teaching

Hachey (2013) notes that many early childhood educators are reluctant to teach mathematics in preschool and tend to emphasise the importance of social, emotional and literacy development. Reasons for this belief are thought to stem from a firm conviction in the adoption of developmentally appropriate practice (DAP). DAP reflects a pedagogical approach where educators facilitate child-initiated learning by providing a rich and stimulating environment, where learning is opportunistic rather than intentional (McCray & Chen, 2011). The National Association for the Education of Young Children (NAEYC;2020), in a position statement on DAP, defines the term as "methods that promote each child's optimal development and learning through a strengths-based, play-based approach to joyful, engaged learning". This definition positions young children as being central to a responsive, playful pedagogy.

Pre-service preschool teacher education has, in the past, focused on supporting young children's social and emotional development. Some pre-service programs advised that intentionally teaching mathematics in preschool classrooms was unsuitable (Lee & Ginsburg, 2009) and unnecessary and potentially harmful to child development (Gifford, 2003; McCray & Chen, 2011). Lee & Ginsburg

(2009) suggest that these beliefs have held a long-lasting effect on early childhood pedagogy, where mathematics is often linked with direct instruction and the use of didactic equipment, strategies that are seemingly in opposition to the existing beliefs and established practices of free play and a play pedagogy. Pollitt, Cohrssen and Seah (2020) note that these beliefs still continue to influence the incorporation of mathematics in preschool curricula, despite current research that demonstrates that young children are capable of engaging with complex mathematical concepts (Hachey, 2013). Pollitt et al (2020) see the continuation of these beliefs as problematic. McCray and Chen (2011: 256) concur with this statement and suggest that this belief and commitment to DAP, coupled with a belief about what mathematics education is, facilitates the assumption that it is 'developmentally inappropriate' to engage young children with mathematics. Platas (2015) identified the effect of beliefs on the implementation of mathematics instruction in the early childhood classroom as a major challenge facing the ECE field regarding the support of mathematical development.

Methodology

A Qualitative research approach was chosen to elicit the thoughts and views of eight Irish early years educators on the provision of mathematics in their early childhood practice. An interpretivist perspective was engaged as it was believed that participants hold their own views and opinions on a given subject based on their own lived experiences (Bryman, 2016).

Research Method

Qualitative semi-structured interviews were employed in this study. Semi-structured interviews provide a flexible method of gaining insight into participants' views on a topic (Greig, 2013) and allow participants to expand on issues that are significant and meaningful to them (Bryman, 2016). Interviews allow participants time to think over responses and to consider answers carefully (Mack et al., 2005). Semi-structured interviews were chosen over questionnaire survey data collection methods, as it was thought that questionnaires would provide insufficient detail about beliefs and practices (Walliman, 2014) or reveal only limited aspects of participants' thinking (Hochschild, 2009) about mathematical activity in preschool. The majority of participants were interviewed in their preschool classroom. This enabled participants to refer to mathematical equipment and activities as present in the room.

Research Sample

Eight early years practitioners were interviewed over a three-month period. Convenience sampling was initially used as practitioners who were known to the researcher were interviewed. However,

purposive and snowball sampling techniques were also utilised to recruit participants (Cohen, Manion & Morrison, 2018). The eight participants varied in level of qualification and length of practical experience, from those completing a level 6 qualification in Montessori teaching to those with an honours Bachelor's degree in Early Childhood Care and Education.

Table 2 Participants' Qualifications and Years of Experience

Participant	Gender	Qualifications	Years of Experience	Type of Setting
1	Female	Level 8 Degree Early Childhood Level 6 Montessori Teaching	19	Play-based
2	Female	Level 7 degree in Early Childhood Level 6 Montessori Teaching	15	Play-based
3	Female	Level 7 Diploma in Early Childhood Studies & Practice	5	Play-based
4	Female	Student Montessori Teacher (working as an assistant)	4 months	Montessori
5	Female	Level 6 Montessori Teaching	26	Montessori
6	Female	Level 6 Montessori Teaching	15	Montessori
7	Female	Diploma in Preschool Practice Diploma in Montessori Teaching	15	Montessori
8	Female	Level 6 Montessori Teaching	12	Montessori

Data analysis

The transcribed data were analysed by *thematic analysis* (Braun & Clark, 2006). Bryman's (2012) four stages of data analysis were applied to the transcriptions: familiarisation with the data, labelling the data, coding the data and interpreting the data. Codes were assigned to ideas presented in the data, and categories were decided by grouping these codes together. Coding is a way of identifying themes throughout the data (Bryman, 2016) and determining themes or categories stemming from these codes. Connections between the themes were made based on the researcher's literature review.

Ethical Considerations

Informed consent was sought from all participants. Participants were given an information sheet detailing the research procedures and outlining any potential risks that might arise from engaging with the study. Participation was wholly voluntary, and participants were free to withdraw from the study at any time. Confidentiality was assured, and pseudonyms were used to maintain privacy.

Participants were recruited from a range of settings and practitioner qualification levels. A 'leave no harm' policy was upheld by the researcher for the duration of the study and beyond. The researcher

Templates/copies									
Counting songs									
Playdough									
Problem-solving									
Division (sharing)									
Maths Outdoors									
Counting									
Sorting materials									
Hopscotch									
Construction									
Measures									

Practitioner Perceptions of Mathematics in Early Childhood

Maths is a fundamental skill for life and for understanding the world

Data analysis showed that the majority of participants thought that developing mathematical skills in young children was vital in order for them to understand the workings of the world around them.

“they (maths skills) have a place, cos in order for the child to understand the world around them, they have to understand maths” (Participant 3).

One participant commented on how the focus on concrete, practical mathematics such as weighing, measuring and estimating should be the focus of early childhood mathematics.

All participants mentioned recognising numbers and counting as a chief skill for young children to master, as numbers feature heavily in children’s everyday environments. There was a consensus among participants that numbers (naming and recognising) and counting were the most important mathematical skill young children should master.

“my understanding of children and mathematical learning is mostly about counting”
(Participant 1)

However, participant responses varied as to the emphasis that should be put on numbers and counting during the pre-school phase, referring to children’s interests and pace of learning:

“I’m not a big believer in them knowing numbers and they leaving here, if they do, it’d be brilliant”
(participant 3).

When asked if there were any mathematical concepts that pre-school children should not learn, participants mostly agreed that children could learn anything, but that abstract concepts such as addition and subtraction should not be taught formally, rather informally through play and songs.

Montessori participants disagreed, with three participants referring to children doing 'sums' in a copybook.

The Child as a Learner

The majority of participants agreed that young children are capable learners.

"I think we underestimate children drastically...they are capable of anything and learning anything" (Participant 5).

"Children want to be challenged, they want to be doing something a little harder" (Participant 8).

Most of the participants valued the role of free time for play in children's mathematical learning and development. The two participants with Bachelor's degrees in early years articulated clearly how a child can learn through play and from their environment, providing several rich, descriptive examples of mathematics, observed in children's play, for example:

"at the playdough, when they're rolling it out, and they're making a necklace or a bracelet, they have to get the length of it, they'll test it out on their neck...it's not long enough, I'll have to get another bit" (Participant 3).

Most of the participants felt that mathematics needed to be introduced in a fun way to foster early positive dispositions towards mathematics early on.

"It's all about liking it, making it fun, and if it's boring, then you have to do something about it" (Participant 6)

Two participants (Montessori practitioners) did not place much emphasis on free play in terms of fostering and developing mathematical skills, preferring to follow the sequential mathematical exercises of the Montessori curriculum.

"I don't think it'll (play-based pedagogy) focus them (children) as it should do" (Participant 5)

Most of the participants were adamant that young children should be allowed to learn at their own pace. These practitioners were mindful of not pushing a child to learn mathematical concepts they did not want to learn or when they felt the child was not ready to learn them.

"pushing a child to do something he doesn't want to, just to tick a box...that would be terrible" (participant 7).

One participant noted that if a child was particularly interested in mathematics, they would endeavour to encourage them on their mathematics journey:

“I think if they have an interest in it, they have that interest for a reason...show them, give them a taster of it...what harm would it be?” (Participant 5).

Findings show that participants viewed children as being capable and competent learners, who are adept at learning complex mathematical concepts. This view is shared by researchers in early childhood mathematics education (Perry & McDonald, 2015). Participants also believed that mathematics should feature in early childhood curricula as it was strongly linked to everyday life.

Fear of Doing too Much

Five of the eight participants admitted that although they follow the child’s lead in readiness to learn mathematical concepts, they were concerned about doing ‘too much’ in case the child would be bored in primary school. One participant expressed concerns that the ECCE pre-school years scheme may result in children becoming bored in the Junior Infant Class in primary school:

“I mean with this new Free Preschool Year scheme, children will be five, or nearly five, going to primary school and will have many of the math concepts already learned” (Participant 2).

This belief affected the type of mathematical activities done in this participant’s setting:

“I do focus on shapes, numbers and matching and sorting, but I try not to copy Junior Infant work” (Participant 2).

Participants four and five agreed with these sentiments, stating:

“I know when they go to National (Primary) school they do 1-5 in Junior Infants and 6-10 in Senior Infants, so you don’t want to go beyond that in preschool” (Participant 5).

“I could teach addition...however, when they go into school then they’ll know all that already” (Participant 3)

“sometimes I worry about sending a child to school with too much...I fear that the child will, be bored and have less respect for the teacher because she’s not moving at the pace the child needs to move at” (Participant 7).

Social, emotional and language development is more important than mathematics

Two of the participants felt that it was more appropriate to focus on social, emotional and language development rather than on mathematical development.

"I'm very focused on language, you know, having conversations and explaining things...I'm more socially minded, so I focus on emotions and feelings" (participant 1)

Participant 2 was very clear that personal and social development is an important component in an early years curriculum. This participant referred to boosting resilience, building confidence, and fostering respect for others.

Role of the Practitioner

Laying the Foundations

Four of the participants stated the importance of the early years as an important time to introduce mathematical concepts to young children, with one participant acknowledging that early childhood is the optimal time for children to absorb ideas (participant 4). These practitioners favoured a more interactionist approach, where the adult actively supports the child in learning new mathematical concepts and fostering dispositions.

"you have to sow the seed for them, in order for them to pick it up and run with it because sometimes they don't notice the concepts of mathematical things until you actually show them" (participant 3).

Facilitator of the Environment

Participants saw their role chiefly as that of facilitator, one who provides the environment and mathematical resources for play and exploration. Participants stated that children benefit and learn from a richly resourced environment. Montessori-trained participants noted the importance of the environment in free exploration and facilitating choice in child-led mathematical activity.

"I have to provide an environment that challenges the children to think...to extend the child's math ideas in their play" (participant 2)

When questioned about their adult role in fostering mathematical skills, the two degree-holders noted how experience counts when knowing when to intervene in play (to develop it) or when to step back, they saw themselves as guides to lend support.

The two degree holders also stated that they had an important role in extending children's play activities and in challenging the child to think about mathematical concepts through open-ended questioning.

“you’re constantly using open-ended questions...you’re conscious of getting them (children) to just think about things” (participant 3)

Discussion

Findings revealed that participants provided, in the main, a limited number of focused mathematical activities, centred around numbers, counting, shape and measures (See table 3). This practice is well noted in the literature (Trawick-Smith et al., 2016; Lee & Ginsburg, 2007). However, many researchers claim that young children should be exposed to a broader mathematical foundation, including concepts such as pattern (algebra), space, data handling and operations (NCCA, 2014: Early Math Collaborative; 2014). Indeed, Aistear the Early Childhood Curriculum Framework (NCCA, 2009) calls for children to engage in a range of mathematical concepts (Table 1). Participants believed that a role of the early childhood educator was to lay the foundations for future mathematics learning. This study asks, how can participants be laying the deep mathematical foundation called for by Aistear (NCCA, 2009) and by researchers (Dunphy et al, 2014) if they are focusing on the teaching of numbers, counting and shape? Could it be that the mathematical content, outlined in the learning goals for the themes of Communicating and Exploring and Thinking in Aistear (NCCA, 2009) focus too narrowly on Counting, Shape and Measures and that aspects of mathematical thinking e.g. problem-solving, justifying, reasoning etc. are not explicitly linked to mathematics. Could this prevent practitioners from identifying these processes as being mathematical in nature? Other aspects of mathematics, such as pattern feature in the sample learning opportunities section for Exploring and Thinking, but are not stated in the learning goals. Data handling is explored through comparing, sorting, categorising and ordering in learning goal 6 in Exploring and Thinking. However, these activities were rarely mentioned by participants.

Given that specific mathematical goals are explicitly stated in Aistear, it is interesting to note that participants did not refer to the aims and learning goals relating to mathematics in Aistear during the interviews. Further studies are needed to explore practitioner engagement with Aistear from a mathematical perspective and to investigate the types of mathematical experiences offered in Irish preschool classrooms daily.

All participants were adamant that they adopt the mantra of following the child’s lead, in terms of waiting for the child’s readiness and willingness to engage with mathematics. Research (Lee & Ginsburg, 2009; McCray & Chen, 2011) suggests that these beliefs and practices stem a firm belief and commitment to DAP, and this has prompted practitioners to hold off introducing more complex abstract mathematical concepts until the child is developmentally ready.

The philosophy of following the child's interests and needs could lead to the exclusion of some children, in terms of mathematical input from educators. Adults decide what information to share and with whom. Adults hold a powerful position and must ensure that all children are afforded time to develop their mathematical knowledge and mathematical interests. Several participants voiced concerns about 'doing too much' for fear of children being bored in primary school. One participant admitted that, although they would follow a child's interest in mathematics, they would fear that the child may become disruptive in primary school because the teacher would go at the pace of the majority and not that of the individual child, who may have covered the concepts already in preschool.

There appears to be a conflict of beliefs here. The belief of 'following the child' and the belief or fear of crossing the line between what is perceived as mathematics for preschool and what is required in primary school. For future studies, it may be worth exploring why this is the case. Aistear (NCCA, 2009) is a unifying curricular framework that bridges practice between preschool and primary education, and yet, we see evidence of a perceived divide in required curricular practices. Findings from this study suggest that there was uncertainty among participants as to what mathematical content should be covered in preschool education. This is worrying as Aistear (NCCA, 2009) provides a list of mathematical concepts that young children should engage in (see Table 1). It appears, however, that the mathematical concepts listed in Table 1 do not provide enough guidance. The current separation of the learning goals from the sample learning opportunities (SLOs) may be hindering practitioners' ability to connect the goals to mathematical activity. There may be a case for combining the goals and the SLOs in future revisions of Aistear to ensure coherent guidance for practitioners.

Findings suggest a number of questions for future exploration:

- What do practitioners understand by mathematics in preschool?
- Are these findings a sign that practitioners do not understand the mathematics that children engage with daily in the preschool environment and in their play, e.g. matching, sorting?
- Why are practitioners afraid to follow a child's mathematical interests?

Findings also indicate that there is a necessity for training in early childhood mathematics for preschool educators. This echoes the recommendations put forward by Dooley et al (2014). Research concurs that training is beneficial to a practitioner's ability to pick out mathematical concepts in children's play (Cohrssen et al., 2016) and also to the ability to extend the mathematics in episodes of play (Oppermann et al., 2016). German research (Oppermann et al., 2016; Anders & Rossbach, 2015) suggests that early childhood practitioners need to be schooled not only in

pedagogical strategies to enhance mathematical development but also in the subject of mathematics itself. Both degree-holder participants had received training in mathematical pedagogy during their degree programmes.

Conclusion

This study has shown that Irish pre-school educators value mathematics as an essential component for developing life skills. However, findings show that, in the main, practitioners provide a very narrow mathematics curriculum, focusing heavily on numbers, counting, measures and shapes. Other mathematical concepts, such as pattern and space did not feature in participant interviews as often. This narrow curricular view of pre-school mathematics is in opposition to the broader perspective of mathematics envisioned in the National Literacy and Numeracy Strategy (DES, 2011). International research also supports the implementation of a broader mathematical foundation at the pre-school level.

While this research study has not overtly examined the mathematical knowledge of the participants, the fact that they provide such a narrow range of mathematical activities and focus might suggest that they have not been adequately trained in the area of early childhood mathematics. Only two participants had training in mathematics through play. The other play-based participant had no training in preschool mathematics.

With this information in mind, this study recommends that all Irish pre-service courses in Early Childhood Care and Education include a mathematics module that covers both pedagogical strategies and mathematical subject knowledge. The needs of in-service practitioners should also be addressed.

In order to address the concerns highlighted, this study recommends that Irish educational policy needs to work towards developing a more cohesive system within the early childhood phase. A cross-sectoral curriculum framework (Aistear) is already in place, but this research advocates the provision of mathematics teacher education across the pre and primary sectors. Such a training initiative may help practitioners to understand the mathematics education that children experience on entering primary school, and so alleviate any concerns they may have in relation to acknowledging and responding to children's mathematical interests. It is also of great importance that primary teachers need to respond to the varying mathematical funds of knowledge children bring with them to primary school. Cross-sectoral training may serve to facilitate the mathematical needs of children as they transition from one educational setting to another.

This study explored the beliefs of a small sample of early years practitioners regarding the provision of mathematics in their pre-school rooms, thereby contributing an Irish component to the increasing international research on this topic. It has shown that, in the main, participants demonstrate a positive outlook towards mathematics in the preschool classroom. Findings revealed that participants were unsure what to cover mathematically, and there was a major focus on numbers, counting, measures (capacity) and shape. However, due to the small-scale nature of this piece of research, it cannot be taken to represent Irish early childhood practitioners in general. Therefore, this study recommends that further large-scale research be carried out to ascertain the general standard of Irish pre-school mathematics provision and to investigate the nature of mathematical activities provided. There is a necessity to explore the complex interplay between beliefs and practice – beliefs about the nature of mathematics, early childhood mathematics education and appropriate pedagogies for mathematics in early childhood.

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