Trimangles and Kittens: Mathematics Within Socio-dramatic Play in a New Zealand Early Childhood Setting

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In prior-to-school early childhood settings mathematical play can occur in a natural and unstructured manner. This paper describes the findings of a case study of children in an urban Auckland early childhood centre engaging in socio-dramatic play in the family corner. This data gives rise to the notion that foundational mathematical knowledge can, and does, develop in very young children.

The socio-constructivist approach and theoretical framework as espoused within the New Zealand early childhood curriculum framework *Te Whãriki* (Ministry of Education, (MoE) 1996) implies that children are gaining experiences, which relate to future academic learning, while they play, in natural and in institutional environments. Within *Te Whãriki* (MoE, 1996) curriculum is defined as "the sum total of the experiences, activities, and events … which occur within an environment designed to foster children's learning and development" (p. 10). It is these experiences, activities and events that can contain rich mathematical activities and in turn form the foundation of future mathematical skill (Babbington, 2003). This paper highlights some of the key findings of a recently conducted case study, focussing on children's natural mathematical play, which was observed in a prior-to-school, early childhood setting.

Method

This case study investigation included observation of a family play area (family corner) incorporating voice recording of children's conversations. The data collected included a combination of photographs of the physical layout, researcher journal, and voice recording in order to record the language children used while playing. Participants included all children who chose to enter the family play corner during the periods of observation. The age range of these participants was between 18 months and 4 years of age, although the main players throughout the observational period of two weeks were all over 2 years of age.

Results and Discussion

On the first morning of the case study data collection the children were rearranging the family play corner equipment within the setting. During this time several significant mathematical aspects occurred. Two children carried a child-sized bed into the new area and placed it along one wall in the room, however, approximately 30cm of the bed was jutting into a doorway. The children noticed this and one child stated that it did not fit and they would have to find another place for it. After several minutes of trying a variety of places they decided to move a set of drawers so that the bed could fit in, and it did. The practical measurement and geometrical knowledge (spatial rearrangement) evident in this anecdote is supported by the work of Giglio-Andrews (1996) where she states that actions such as these

build the foundations upon which children learn about formal geometric concepts.

Once most of the furniture was in place an adult placed a basket of plastic cutlery into the centre of the table. A child (4 years) tipped it out and sorted the cutlery into categories by colour; "red ones here, white ones here" as he placed them into a cutlery tray.

Classification of this type is also seen in the work of Kirova and Bhargava (2002) where they researched mathematics within a play-based curriculum and found evidence that mathematical understanding can be observed in children's socio-dramatic play. Their findings described a variety of early concepts specifically those of one to one correspondence, classification and seriation. This anecdote shows evidence of classification by attribute (colour and shape) and occurred in a variety of play episodes recorded over subsequent observations.

Another example of this was when some plastic crockery and cutlery had just come out of the dishwasher and was placed onto the table in the family corner. A 4-year-old child immediately sat down and started to dry this equipment with a tea towel, as they were still wet. As she dried each piece she placed them carefully into discrete groups of plates, cups, knives, spoons, forks, and bowls. The actions of this child showed her knowledge of hygiene practices and routines in the home and at the centre and an understanding that objects can be categorised into groups showing further evidence of this young child's classification skills.

Intellectualising about number knowledge was observed. A group of children were sitting at a table, one 4-year-old child had a plastic "play" biscuit and was pretending to cut it down the centre with a knife. As she did this she stated "half for you and half for me".

The concept of halves was also discussed at other times. A 3-year-old child had placed a small amount of play dough onto a plate "Toast is on the plate but I still need more honey, not enough, I going to cut it in half", as she cut the play dough into two pieces. This demonstrated an understanding of the concept that one half is one of two pieces regardless of whether she understood the equivalent nature of fractions. These two anecdotes support the work of Smith (1998), "It is important that teachers and parents realise that when children play imaginatively they are not being frivolous but are practicing important intellectual and social skills, which will help them develop in many areas" (p. 27). The intellectual skills that children exhibited while engaged in the play described above were observed in further episodes.

Birthdays as an aspect of number were a recurring theme particularly when play dough was available in the area. For example, a 3-year-old child said "look at my cakes, 'tis for you (looking at researcher) you are four, gonna be four." She then pushed three small forks into her play dough "cake". At this point another child (4 years) at the table stated, "no that's three you need another candle." The cake was then cut into six small pieces as the 3-year-old counted, "one, two, one, two, one, two." The second child in this anecdote displayed the skill of subitising, as she immediately knew how many "candles" were on the play dough cake without needing to count them. She was also able to show her knowledge of simple addition when she recognised the first child's mistake. The patterns of counting were beginning to be explored here by the 3-year-old as she counted six pieces of "cake" in twos. Carr, Peters, and Young-Loveridge (1991) described this clearly in their work with 4-year-olds where children could count in twos and in fives when prompted. This early mathematical conceptual understanding is the foundation for future mathematical skill and understanding in a wide range of mathematical areas such as addition, subtraction, and multiplication (Maclellan, 2000).

Other aspects of number that were observed were those of simple addition and subtraction. In a recurring and very popular game of "mum and the kittens", three girls (3 years, 3 years, and 4 years of age respectively) were approached by a fourth child to join their game. When he stated that he wanted to be a kitten too, the "mum", a human mother character, responded that there were not three kittens only two but he could be a dog if he wanted to. When one of the "kittens" left the play area "mum" then shouted out "hey there's only one kitten now!" The inherent knowledge that two plus one more makes three, and that two minus one equals one, was clearly part of this child's experience. This simple addition and subtraction is one of the major aspects of mathematical relationships as it eventually leads to the child's understanding of quantification (Geist, 2001).

Counting as a measure of time was observed alongside geometrical shape knowledge. A 3-year-old child at the play dough table had cut a small piece of dough into an equilateral triangle," here's your trimangle [sic] cake, it's your favourite, vamilla [sic]." She took the play dough "cake" to the play oven and placed it inside saying, "1, 2, 3, 4, 5, 6, 7, 8, 9, 10, ready now." Children may use counting as a way to measure time, length, weight, distance, speed, or volume (Maclellan, 1998) and this anecdote clearly supports this claim. Identification of common geometrical shapes is a natural experience and in the anecdote above the child describes a play dough creation as a triangle. This is supported by the work of Oberdorf and Taylor-Cox (1999) where they describe children's geometry as the way in which they make sense of their world.

These findings give strong evidence to the tenet that very young children have complex mathematical knowledge. Unless children's play is viewed with a mathematical lens the mathematics can go unnoticed and seem frivolous (Pound, 1999). Of course not all play is mathematical or has mathematical components but there are obvious examples as discussed in this paper. Within this study children exhibited clear knowledge and understanding of classification, geometrical shapes, counting as a measure of time, patterns in numbers and routines or rituals, passage of time in relation to age, spatial awareness, simple fractions, and addition and subtraction. These mathematical experiences and conceptual understandings will provide the basis upon which future mathematics can be built (Babbington, 2003; Dockett & Perry, 2002; Hedges, 2003; Geist, 2001).

Conclusion

The findings of this study have shown that the young children within this setting performed mathematical inquiry naturally and without adult interaction or intervention. Ginsberg (2006) further supports the key findings of this investigation and refers to children's everyday mathematics as a natural and fundamental aspect of all children's learning: "children have the capacity, opportunity, and motive to acquire basic mathematical knowledge" (p.148). Ginsberg goes on to claim that early mathematics is the foundation for learning in many other subject areas such as reading, scientific knowledge, and construction.

The notion of play as the catalyst for children's learning (Dockett & Perry, 2002) will continue to be explored through gathering further empirical evidence of the ways in which mathematical exploration occurs in early childhood and will continue to inform research in, and about, early childhood education. This could include considering the importance of listening to children and carefully observing their play in order to identify mathematical knowledge. This is highlighted strongly within the examples in this paper but much more data could be gathered and analysed to find out what children know and can do. It is also important to remember that any learning and

teaching should be enjoyable for all involved. As *Te Whãriki* states, it is expected that mathematical ideas will amuse, inform, delight, and excite (MoE, 1996) for all those who engage with early childhood education.

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