

School Readiness: What Do Teachers Expect of Children in Mathematics on School Entry?

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This paper explores the perceptions of teachers of five-year-old children and the expectations these teachers have of the children when they begin school in terms of their level of mathematics knowledge. Teachers were asked about their beliefs in relation to mathematics teaching and learning and how they thought children best learned mathematics. This was matched with classroom observations to compare teacher practice with teacher beliefs. A significant finding was the general lack of attention that teachers paid to the knowledge and skills that children had when they started school. There was a lack of consistency between what teachers said they believed in compared with what they actually did in the classroom.

This paper is a study on teacher beliefs and practices regarding the nature of the mathematical knowledge that five-year-old children enter school with. These beliefs have the potential to impact on the nature of the mathematics programme that the teachers present to the children and the factors that contribute to this programme. Schooling differs from children's prior experiences at home and/or at pre-school in that schooling in general has a focus on more structured procedures specific to the school environment. Peters (1998b) reported on the importance of primary teachers understanding the knowledge and skills that children already possess when they start school. She emphasised the fact that "children need to learn to make sense of school" (Peters, 1998a, p. 107) in that they develop awareness of the school situation and shape their learning to the confines of the classroom (Jackson, 1987). While there are a range of tools that primary teachers have available to use with children when they start school, Dockett and Perry (2001) indicated that teachers were more concerned about the child's ability to socialise rather than their academic ability. The following research looks at teachers' beliefs and practices relating to the mathematical knowledge of children when they begin school (at 5 years old in New Zealand).

Rationale

Clay (1991) described the child's entry to school as "not the beginning of development or of education in its' broadest sense; but it is the beginning of society's formal attempt to instruct all children, in groups" (p.19). The New Zealand system is one of the very few in which children begin school on or about their fifth birthday. The new entrant (emergent) class teacher has a continuous supply of individual children joining the class throughout the year from a variety of pre-school environments. Teachers within the primary sector were found to have insufficient knowledge of the children's achievements in the early childhood area and were thus unable to effectively support children by building on their prior knowledge (Timperley, McNaughton, Howie, & Robinson, 2003). Primary teachers held the view that it was important when children settled into school, they behaved in a way that was acceptable to the teacher (Renwick, 1987), implying that the social aspect of the new entrant classroom was of primary importance. The children are required to fit into the school system.

New entrant teachers are able to accurately assess where children are in terms of their mathematical content knowledge within days of the children starting school and yet the same teachers then spent the rest of the year teaching 80% of the children what they already knew along with giving multiple opportunities to practice their existing skills (Young-Loveridge, 1998). Results from the EMI-4 study (Young-Loveridge, Carr, & Peters, 1995) reported that when children in their study were ready to start school, 80% of children could rote count to 10, 42% could accurately count a group of 5 objects and 55% of these same could join a set of 2 and a set of 3 to make a set of 5 objects, indicating a significant level of mathematical competency.

The term 'school readiness' is used to describe a variety of understandings of what children need to know in order to be successful at school entry. The social promotion policy in place in New Zealand schools contributes to the notion that at particular stages/ages children have mastery of particular skills, strategies and knowledge. Evidence from the EMI-4 study (Young-Loveridge et al., 1995) demonstrated that children

have relatively stable numeracy skills at age 5 and a considerable range of achievement levels and yet some teachers commented that they were only familiar with a small section of the mathematics curriculum as their children passed on to the next class level relatively quickly. This would suggest that these teachers had little awareness of the range of abilities these children possessed, and in fact they assumed a readiness for children to move on after a short period of time in the new entrant classroom adjusting to the ways of the school. Many teachers had a pre-determined view of the mathematics skills of five-year-olds when they started at school followed by firm ideas on what these same children needed to acquire before they moved to the next level, irrespective of the children's current skill levels.

Mathematics teaching and learning in New Zealand is currently guided by the New Zealand Curriculum Framework (Ministry of Education, 1993) and Mathematics in New Zealand Curriculum (Ministry of Education, 1992). Neither document specifies the level of achievement nor the level of mathematics knowledge expected of children when they begin their formal schooling.

At mathematics time in the new entrant classroom the teacher is primarily working with small groups of children while the other children are working on independent or practice activities for mathematics. The teacher is usually working alone, sometimes with the support of a teacher aide who may take responsibility for the supervision of a group working on a practice or an independent activity. The direction of the learning is generally determined by the teacher.

Many of the theories relating to mathematics learning, held by teachers of 5 year old children, which underpin classroom practices, are based on management procedures and classroom activities to support these. When teachers make decisions in their classrooms relating to how children learn, they appear to be based on teachers' personal beliefs rather than on some particular education theory based on specific knowledge (Bell, 1990; Farquhar, 1991; Spodek, 1988). McCaslin and Good (1992) found that many primary teachers' expectations of children when they [the children] commenced school were focussed on socialisation and direct instruction. "Work is seen as something they [the children] must do, while play is seen as something they [the children] can do" (Spodek, 1988, p. 163). This view reflects the idea that when children begin school it is the children who need to conform to the school expectations and fit in. The underlying message conveyed to the children is to obey (Biber, 1988), described by McCaslin and Good (1992) as "compliant cognition". Management practices in the classroom focus on conformity and order rather than on the intention of the curriculum to produce self motivated and active learners (Ministry of Education, 1992).

Methodology

A purposive sampling approach was used to select five schools from a similar geographic area, with decile rankings¹⁰ ranging from 1 to 10. The schools were selected due to a prior relationship with the author, having already participated in the Numeracy Project professional development programme. The research involved semi-formal interviewing of the five new entrant teachers regarding their beliefs about how they decided what was important for them to teach children when they started school in mathematics followed by two observations of their classroom practice. Teachers were asked how they thought children best learned mathematics and what they believed was important to develop in their mathematics programme.

The questions in this semi-formal interview were adapted from a study by Miller and Smith (2004) that enabled themes to be gathered from the information from the interviews. The characteristics of an interviewer inevitably have an effect on the interviewee and the interview (Denscombe, 2001) and every effort was made to overcome these by attempting to maintain a passive stance while supporting the interviewee to be frank.

Two three-hour observations were conducted in each classroom focussing on the kinds of mathematical interactions that occurred. Data was recorded at five minute intervals as to the event that was occurring and full details were recorded of mathematical events. The observer was positioned as discretely as possible in each classroom to minimise the possible observer effects.

The interviews were conducted first, followed by the two, three hour observations over a two week period. The data was gathered during the first half of the school year.

The ethical guidelines of the New Zealand Association for Research in Education were followed in this

10 The decile rating of a school is based on a Government assessment of the school in terms of the nature of the school community, particularly regarding the predominant socio-economic make up of that community with 10 being the highest.

study and no teacher or school is able to be identified. Interviews were not recorded by dictaphone but were transcribed and given back to the participants for verification as the participants felt more comfortable with this form of interviewing.

The interview transcripts were analysed and categorised by major themes related to teacher beliefs about mathematics education to look for similarities and differences. The major themes decided on were the “units” used for analysis. This process is referred to by Denscombe (2001) as unitising the data. The observations were similarly categorised to elicit major themes relating to teacher practice in a mathematics classroom.

The major units chosen for analysis were related to:

- Teacher beliefs regarding children’s learning of mathematics;
- Teacher perceptions of 5 year old children’s mathematical knowledge on school entry;
- Teacher practice as observed relating to the following categories: directing learning, supporting learning, organising learning and evidence of specific mathematical interactions; and
- Teacher usage of curriculum.

Results

Teacher Beliefs Regarding How Children (Age 5) Learn Mathematics

All the teachers in this study believed that children learned mathematics by being exposed to hands on problem solving experiences that were fun. Children learned best by physically doing the problems and the teachers’ role was to provide activities that supported the children as they learned. The teachers stated that it was important to cater for the children’s own interests as this contributed to successful learning. Teachers believed that they provided a safe environment that allowed the children to develop the ability to take risks and move forward in their learning.

The Knowledge of 5 Year Olds on School Entry as Described by the Teachers

Without exception the teachers had a clear set of expectations relating to children when they started school, not just in mathematics but in every aspect of learning. The teachers felt that children should have some sound academic skills in place before they arrived at school. That is, children should know their letters and some numbers (Aorangi School), they should have the ability to sit for longer than five minutes (Cascade School) and they should have the ability to count and recognise sets of numbers (Dundass School). All the teachers mentioned the importance of the children being socially able to function at school in terms of being able to take turns, sit on the mat and be more focussed. The expectation of the teachers was that these skills should be put in place during their early childhood years.

These expectations were specific in all cases and clearly outlined the behavioural and knowledge levels the children should have when they begin.

When children are nearly ready for school they need less play and more time preparing for school, like learning how to count and know their letters. (Aorangi School)

The Mathematics curriculum (Mathematics in New Zealand Curriculum – MiNZC) states an achievement objectives for level one (approximately 5 -7 years of age) as “make up, tell and record number stories up to 9 about given objects and sequence pictures” (Ministry of Education, 1992, p. 32). But the teachers already had clear expectations of what they expected the children to have mastered when they commenced school.

The MiNZC states that by the end of level one children should be able to “form a set of up to 20 objects” (Ministry of Education, 1992, p. 32). But on school entry, project teachers stated that:

I want them to know their basic number concepts and how to make small sets of things. (Cascade School)

Children should come to school being able to write their names and know some letters of the alphabet and be able to interact nicely. (Tongariro School).

Teacher Practices

The teachers had a clear vision of where they wanted the children to go in their mathematics learning. The classrooms were warm and caring with a variety of good mathematics displays and the teachers were concerned with children's learning. The teachers were in control in the classroom directing the learning of the children to ensure that all the gaps were filled. The teachers unanimously agreed that because the children came to school with limited skill levels, they (the teachers) had to plug these gaps before they could teach the children how to problem solve.

In terms of classroom practices, the teachers believed that it was important to provide meaningful and fun activities, to engage the children in problem solving with mathematics integrated into the whole day in order to develop life-long learners.

Observations of classroom practices portrayed a different story. While the teachers advocated a hands on problem solving approach to mathematics teaching and learning, in reality there was very little interaction in these classrooms. Teachers were firmly in control in the classroom and mathematics lessons followed a tight lesson plan. The format of the teaching was clear and structured and followed the teacher's plans with very little observed adaptations to the children's needs, interest or academic level. Four of the five teachers believed that they knew what 5 year old children needed to know so that is what they taught them.

Curriculum Usage by Teachers

Four of the 5 teachers either did not know where their copy of the relevant curriculum was or did not find it either relevant or useful for their teaching.

I don't need the curriculum documents, I use the numeracy project books instead. I know what children of this age need so that is what I teach them. (Angela at Aorangi School)

I don't find either document useful or relevant. (Donna at Dundass School)

Only one teacher (Tanya from Tongariro School) said that in her team they pulled out specific objectives from the curriculum and planned from these. She did not mention looking at the needs of the children while planning.

Discussion

Teacher beliefs regarding mathematics learning were centred round ensuring that the children had fun and had the opportunity to actively problem solve. In all cases the observations of classroom practice contradicted this more constructivist approach. In the classroom the teachers had a more traditional transmission approach to teaching. The teachers followed their plan and directed the children's learning according to their predetermined intentions (the teachers). There were few opportunities for the children to direct either the pace, the direction of the learning or to actively problem solve. The lessons were delivered with pre-determined outcomes with little or no opportunities for the children to follow their own direction or extend their own learning.

The classrooms were safe and welcoming for children and teachers but within this environment the children are facing few challenges. The teachers had a fixed idea as to the particular needs of children of this age and thus taught to pre-determined plans with little regard to the existing knowledge and skill levels of the children. This combined with four out of five teachers explicitly disregarding the use of the curriculum is a cause for concern.

Lack of specific knowledge relating to the curriculum, suggests that these teachers would have limited knowledge of the curriculum for early childhood, Te Whariki (Ministry of Education, 1996). The teachers, by holding firm views on the knowledge of 5 year old children, do not then need to attend to the knowledge and skills the children already have when they start school, they already know what they need. Teachers, by not attending carefully to children's prior knowledge and skill, run the risk of spending too much time teaching the children things that they already know. By focussing predominantly on behavioural expectations, opportunities for learning may not necessarily be capitalised on.

This is a small study and difficult to generalise from. The lack of knowledge relating to the primary school curriculum and possibly the early childhood curriculum would suggest that there needs to be some significant

professional development in this area. The failure of these teachers to take into account what the children already knew is in direct contradiction to the curriculum which requires teachers to take into account children's prior knowledge and understanding in order to meet the specific learning needs of each child.

Teachers do have clear beliefs about the effective teaching of mathematics for children when they start school but in most instances their classroom practice contradicts their expressed beliefs. More work needs to be done in the area of teacher beliefs and practices to more fully understand these and how they can be shifted for the benefit of the children.

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