

# Mathematical Thinking of Preschool Children in Rural and Regional Australia: Implications for the Future

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The SiMERR project *Mathematical Thinking of Preschool Children in Rural and Regional Australia: Research and Practice* concluded its final report with a series of implications for the future. Many of these have the potential to impact on early childhood teacher education and professional development. In this paper, these implications are considered with reference to other recent studies and with particular emphasis on the development of the national Australian *Early Years Learning Framework*.

The *Mathematical Thinking of Preschool Children in Rural and Regional Australia: Research and Practice* project (funded through SiMERR) concluded in 2008 with the publication of a definitive report (Hunting et al., 2008). The report was based on an extensive literature review of the early childhood mathematics field and interviews with 64 prior-to-school practitioners from New South Wales, Queensland and Victoria. As well, video data were gathered to illustrate best practice in early childhood mathematics education. The report concluded with a series of implications for the future. This paper considers these implications in the light of other recent research on the development of mathematical ideas in preschool children and the needs and challenges faced by early childhood educators in developing these young children to their full mathematical potential.

## Key Findings from the SiMERR Study

As has been highlighted in the earlier papers in this symposium, there were many important findings from the *Mathematical Thinking of Preschool Children in Rural and Regional Australia: Research and Practice* project. These have led to a number of recommendations about how early childhood educators might best facilitate and develop children's mathematical thinking. There are findings about what children might learn, how they might learn, the role of the early childhood educator in this learning as well as the professional needs of early childhood educators in terms of both mathematical content and pedagogy.

### *Children's Mathematics Learning*

Many authors have reported the mathematical capabilities of preschool children (Aubrey, Bottle, & Godfrey, 2003; Bobis, 2002; Greenes, Ginsburg, & Balfantz, 2004; Perry & Dockett, 2005). The early childhood educators interviewed in the project were overwhelmingly in agreement that preschool children were capable of mathematical activity and thought. The following comments are representative of those made concerning young children's mathematical capacity.

- [Children are] capable of deep thinking, prediction, and problem solving;
- There are general mathematics skills in simple tasks;
- Children are natural problem solvers; and
- We underestimate children's thinking and learning capacity. (Hunting et al., 2008, p. 18).

Generally, the mathematics observed in their children by early childhood educators can be classified (by adults) into content strands such as Number and Operations, Algebra, Geometry, Measurement, and Data Analysis and Probability (NCTM, 2000). However, young children see such mathematics as part of their everyday lives. Ginsburg, Lee, and Boyd (2008, p. 3) suggest that

Everyday mathematics is an essential and even inevitable feature of the child's cognitive development, and ... develops in the ordinary environment, usually without direct instruction. Indeed, everyday mathematics is so fundamental and pervasive a feature of the child's cognition that it is hard to see how children could function without it.

Educators interviewed as part of the SiMERR study listed many features of their children's mathematics knowledge and were generally quick to add that these examples were observed during children's play. Play (sometimes called "developmental play" or "play-based learning") is the predominant pedagogical approach in Australian prior-to-school settings. In some instances, educators promoting play tend to not interfere in children's activities. However, recent research, particularly in England, has shown that effective pedagogy in early childhood settings demonstrates the following features:

- a balance of child-initiated and teacher-initiated activities;
- regard for play as a potentially instructive activity;
- complementary focus on social and cognitive outcomes;
- educators with a good understanding of curriculum areas and content;
- a strong focus on educators planning and initiating group work;
- educators providing feedback to learners;
- educators drawing on a repertoire of pedagogical practices as appropriate; and
- social and behaviour policies focused on conflict resolution.

(Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004).

In particular, the importance of *sustained shared thinking* is highlighted. This is a process whereby educators and children are mutually involved in cognitive construction as "each party engages with the understanding of the other and learning is achieved through a process of reflexive co-construction" (Siraj-Blatchford & Sylva, 2004, p. 720). Although no participant in the SiMERR study resorted to research literature to justify their arguments about the mathematical power evident in young children or the most effective way of facilitating mathematics learning by these children, the notions of 'deep thinking' and 'problem solving' suggest some recognition of the importance of 'sustained shared thinking'.

### *Early Childhood Educator Professional Development*

While the participants of the SiMERR study recognised that children were capable of the development of powerful mathematical ideas, many of them suggested that they did not necessarily feel confident in seeing the full extent of children's mathematical knowledge or knowing what was best for them to do when they did notice it. These findings support those from a number of earlier studies (Anthony & Walshaw, 2007; Ginsburg, et al., 2008; Thomson, Rowe, Underwood, & Peck, 2005). Given that early childhood educators' mathematical knowledge and dispositions are very important to their children's mathematics learning (Anthony & Walshaw, 2007; Perry & Dockett, 2008), there would seem to be substantial work in mathematics education to be done in both professional development and beginning teacher education for early childhood educators.

The *Mathematical Thinking of Preschool Children in Rural and Regional Australia: Research and Practice* project makes a number of recommendations concerning early childhood teacher education. Some of the more pertinent to this paper are:

- That information about research relevant to the mathematical thinking and problem solving of young children and infants be incorporated into training, teacher education, and professional development programs.
- That such research information be made accessible to practitioners through opportunities to observe young children together with interpretive commentaries and illustrative videos.
- That training, teacher education and professional development programs provide appropriate emphasis on process aspects of young children's mathematical problem solving and activity.
- That support be given to early childhood practitioners to assist them to recognize, experience, and learn about the mathematical content and processes that they seek to develop in young children.
- That case studies of exemplary practice be documented, analysed, and disseminated. These cases should be illustrative of the range and depth of strategies practitioners use in their engagements with young children.
- That training, teacher education and professional development programs place particular emphasis on affective aspects of mathematics learning and teaching (Hunting et al., 2008, pp. 5-6).

These recommendations not only address the data generated by the SiMERR project but also address the situations observed elsewhere in Australia where there have been calls for teacher education institutions preparing early childhood educators to

ensure that early childhood teacher education programs allocate appropriate time for the study of sufficient and appropriate mathematics and mathematics pedagogy to enable graduates to provide quality programs that ensure mathematical learning for young children in both prior-to-school and school settings (Australian Association of Mathematics Teachers, 2006, p. 4).

Similar calls have been made in New Zealand where it is recognised that “low levels of content knowledge and the resulting lack of confidence about mathematics limit teachers’ ability to maximise opportunities for engaging children in the mathematical learning embedded within existing activities” (Anthony & Walshaw, 2007, p. 47).

## Conclusion

It is quite reasonable to ask why we should be concerned about the state of mathematics education in Australian prior-to-school settings. After all, shouldn't our young children be encouraged to play, enjoy themselves and have fun during the years before they enter ‘formal schooling’?

As documented in this and other studies of young children's mathematical learning, children play with and about mathematics in their everyday interactions. Recognising the mathematics in children's play, responding appropriately and building more complex play situations can serve to promote both play and mathematics.

In Australia, there is currently being developed, trialled or implemented a number of frameworks for the early years that incorporate statements concerning mathematics education in the prior-to-school years. To some extent, these frameworks provide the latest input from governments and education providers on the education of Australian children prior to their starting school. We conclude this paper with some comments on the

relationships between the findings of the SiMERR project and one of these framework statements.

The draft Commonwealth *Early Years Learning Framework for Australia* (Commonwealth of Australia, 2009) lists two learning outcomes in which mathematics education can be discerned. In the first of these, *Children are confident and involved learners*, it is expected that “children [will] develop a range of skills and processes such as problem solving, inquiry, experimentation, hypothesising, researching and investigation” by developing “early understandings about number, patterns, measurement, space and data in real-life situations” (Commonwealth of Australia, 2009, p. 15). In the second of these outcomes, *Children are effective communicators*, it is expected that “children [will] use language to communicate thinking about quantities and their relationships, to describe attributes of objects and collections, and to explain mathematical ideas such as position, direction, order, sequence and pattern” (Commonwealth of Australia, 2009, p. 17). Unless we have early childhood educators who are capable of provoking children to reach these outcomes, what chance will the majority of Australian young children have to reach the outcomes? The need for quality professional development and initial teacher education in the development of early childhood mathematical ideas is clear. To neglect initiatives such as those suggested by the *Mathematical Thinking of Preschool Children in Rural and Regional Australia: Research and Practice* project is to doom these children to mediocrity.

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