

# Numeracy in the early years

PROJECT GOOD START

**SUE THOMSON** from the Australian Council for Educational Research reports on a national project that focussed on improving children's early numeracy outcomes.

**N**umeracy in the early years: *Project good start* was a national project that commenced in 2001, and will conclude this year. The key objective of the project is to improve children's early numeracy outcomes by investigating the practices and learning experiences that support the numeracy development of a sample of children in the year before school and in their first year of formal schooling.

*Project good start* included a quantitative study of children's numeracy development in the year before school and during the first year of school. Case studies of some of these children were also prepared and analysed. Children's before school experiences (including at home, and in preschool and child-care settings) and first year of school experiences were examined, with a particular focus on factors affecting early numeracy development. The project investigated the effects of children's backgrounds (for example, geographically isolated, rural, low socioeconomic urban areas, and areas with high indigenous populations); the different numeracy programs that these children encounter; the beliefs of parents and practitioners regarding numeracy development and learning; effective teaching strategies in numeracy and the identification of 'at risk' children in numeracy.

Pre-school data was received for 1615 children drawn from 81 centres (55 pre-schools/kindergartens and 26 child care centres). About 280 of these children were tracked into their first year of school, and together with their classmates made up a sample of around 1620 children in 44 schools nationally.

## Quantitative data

Quantitative data collection took place in two stages:

### Stage 1

A fourteen-item assessment instrument *Who am I?* (de Lemos & Doig, 1999) was administered by the teachers. This was designed to assess the cognitive processes that underlie the learning of early literacy and numeracy skills in three domains:

- copying of geometric figures (e.g., circles, triangles);
- symbol recognition and awareness (numbers, letters, words, counts); and
- drawing (picture of self).

This instrument is particularly useful for monitoring children's readiness for school-based learning in literacy and numeracy. Three counting items were also added to the assessment, where children were asked how many footprints there were on a page (there were 8), then asked how many would one more and one less than that be.

### Stage 2

Children's numeracy progress was again measured using the *Who am I?* instrument at the end of 2002. In addition, the 30-item instrument *I can do maths* (Doig & de Lemos, 2000), designed to assess children's early numeracy skills in the domains of number, measurement and space during the first two years of schooling, was administered.

Although each item for *Who am I?* is scored individually, indications of the children's achievement is obtained by assigning levels which focus, for example, on how clearly a child can write his or her name, copy a figure, know the number and letter symbols, and draw a person. The reported levels relate to things to look for, for example in scoring 'My name is...' the following levels are appropriate:

Level 0	No response.
Level 1	Scribble, with no recognisable letters from the name.
Level 2	Some recognisable letters from the name, letters formed poorly and an incomplete name.
Level 3	Child produces a recognisable name, but letters formed poorly or name written in reverse.
Level 4	Child produces a recognisable name, with letters generally clear and with only some letters reversed.

Most children were attaining Level 3 or level 4 on the majority of the copying tasks, although there were significant gender differences. For the item *I can draw a circle*, for example, 73% of boys and 86% of girls were assessed at Level 3 or 4 and for the item *I can draw a triangle*, 48% of boys and 60% of girls reached level 3 or 4. The data also show that the majority of Indigenous children were performing at a lower level than non-Indigenous children on the standard *Who am I?* items, and achievement on the extra counting items was

also significantly lower for Indigenous students than for non-Indigenous students. It is not possible to draw firm conclusions, however, because there were Indigenous children at less than one quarter of the preschools sampled.

For the *I can do maths* assessment, there were no significant gender differences in performance on particular items. In general, boys performed better in number and measurement items and girls better on the space items. Indigenous children performed generally at a lower level than non-Indigenous children, and this was significant for about one third of the items for space, number and measurement. Children with a language background other than English also generally performed less well on the items, particularly for number and space.

An explanation for the apparent differences in performance of males and females on the two assessment instruments is that compared with the item content of *I can do maths*, *Who am I?* consists of a higher proportion of items requiring verbal processing and fine motor-coordination skills — areas in which girls (on average) at this stage of development have distinct developmental, maturative and socialisation advantages. However, these results suggest further questions for research: do mothers and female early childhood educators find it easier to communicate with girls, and do so more frequently than with boys? To what extent is positive verbal communication by these persons with girls of greater duration and quality than with boys? What are the key socialisation factors in the home and preschool environments that appear to account for girls' apparent early language/literacy and fine motor coordination skills being more developed at this stage (on average) than those of boys?

## Snapshots in the classroom

The importance of play was a main focus in the philosophy of many centres. Children's growth, socialisation and development were primarily supported through creating possibilities and opportunities appropriate to their age. Children were encouraged to explore, investigate, solve problems and interact socially (see Figures 1 and 2). Children were also encouraged to develop confidence, independence, curiosity, self-control, communication skills and cooperative behaviour. Programs were specifically based on the notion that children learn through play: 'what looks like just play is serious work for children'. For the majority of centres, play was seen as a medium for all aspects of learning.

Overall, all centres were well resourced. While some centres may not have had sophisticated or large quantities of resources due to financial constraints, all centres provided a wide variety of equipment, included items made by the teachers or parents. Generally, centres had a large array of books, materials such as Cuisenaire rods, posters, tessellating shapes, magnetic, wooden or felt blocks, hoops, construction materials such as *Lego* or *Mobilo*, and picture cards for

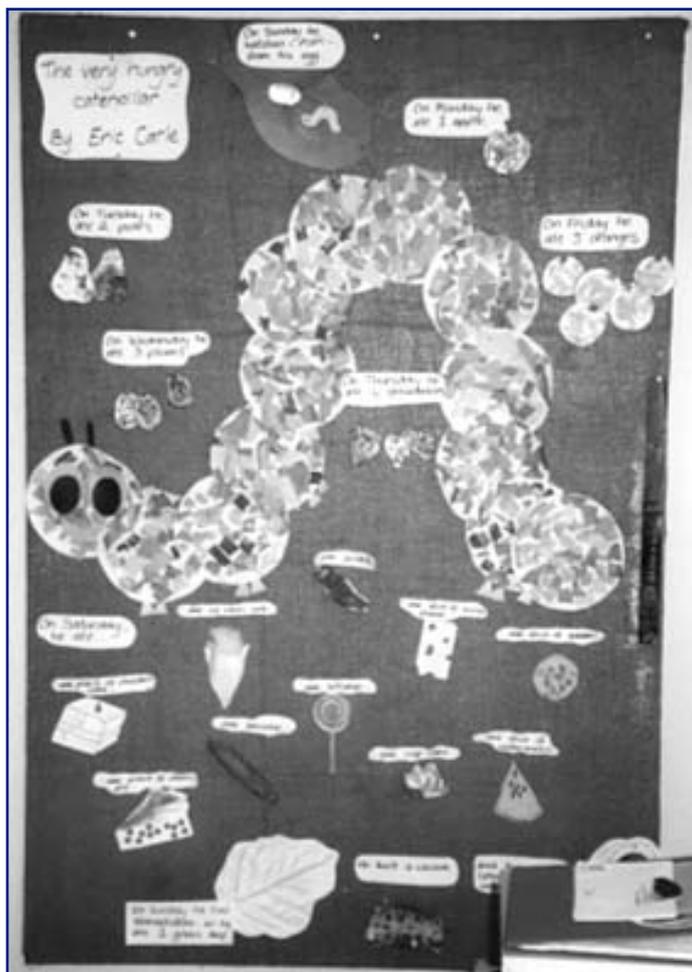


Figure 1. Linking literacy and numeracy.



Figure 2. Children exploring mathematics concepts associated with a story.

sequencing activities. Centres also had equipment such as cups and saucepans that could be used for measuring water, sand or pasta, allowing the children to learn numeracy concepts through their play. Some centres also had computer software available for the children.

Specific numeracy-related activities observed included:

- learning about posting letters (What shape is an envelope? What information needs to go on the envelope for the postman to be able to deliver the letter?);
- whole group activities identifying numbers, learning about odd and even numbers through house numbers;
- singing action rhymes (for example, 'number one touch your tongue, number four touch the floor');
- sequencing activities in which the teacher pulled objects from a bag relating to events that occur during the day;
- cooking biscuits with the associated measuring and counting; and
- playing shopping with pretend money, where the children had to provide the correct money or supply the correct change.

## Factors influencing the provision of a quality numeracy program

Some centres tended to introduce numeracy concepts in a subtle form, through play activities in which the children were not aware they were learning concrete numeracy skills and concepts. While this can be achieved, it is also true for a number of centres that this resulted in children not achieving at particularly high levels on *I can do maths*. It may be that learning numeracy in this manner needs very careful scaffolding, as the higher achieving centres had a focus on systematic rather than random play.

In other centres, numeracy was integrated into the daily program in a more formal manner in preparation for school, including through the examination of numeracy in the every day world. This does not necessarily mean that children were taught numeracy in a regimented manner, but more that the philosophy of the centre included embedding numeracy explicitly into the daily program.

The following areas seem to be key in the provision of a quality numeracy program:

- high expectations and clear goals, and an ability to communicate these clearly;
- an awareness of the need for direct, formal development of children's concepts in numeracy, and so having pedagogical focus on numeracy as well as literacy. Explicit plans for numeracy as a separate area of the program; and
- an awareness of numeracy on the part of the teacher, embedded in materials bought and made, and in the use of mathematical language with the children.

Many of the teachers at the higher-achieving centres spoke of the high expectations that they had of what the children in

their centres were able to achieve. This was frequently in association with high expectations of the children's parents. Higher-achieving centres were generally characterised by systematic and planned play rather than random play. A particular strategy that appeared to work well in a number of centres was developing a program based on interests and ideas arising from the children. In this way children become engaged with what they are learning because it has particular meaning for them, and literacy and numeracy embedded within these contexts becomes more easily understood and enjoyed.

## References

- De Lemos, M. & Doig, B. (1999). *Who Am I? Developmental Assessment Manual*. Melbourne: Australian Council for Educational Research.
- Doig, B. & de Lemos, M. (2000). *I Can Do Maths: Teachers' Guide*. Melbourne: Australian Council for Educational Research.

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