Elizabeth Carruthers

Talking Numbers: a development link between literacy and numeracy

Early Education, Summer 1997. pp. 5 – 6

Research into children's mathematical knowledge is not as prolific as research into writing and reading. Developmental studies of young children's mathematics are rare, especially parent/child studies. The most concise and in depth study of children's number is by Gelman and Gallistel (1976). Their study concentrated on the counting skills of two and three year olds: many of their research findings support my own study. However, like Hughes (1986) their research methods consisted of set tasks and children responding to set questions whereas this study closely observed one child in everyday surroundings and situations. It revealed the child's number knowledge and how she acquired that knowledge: vital information to teachers and parents of young children. Literacy theorists, such as Goodman (1968), Clay (1975). Ferreiro and Teberosky (1982). Cambourne (1988). uncovered children's literacy development by following the flow of the children rather than clinical tasks. They concentrated on what children could do rather than what they could not do. I too, took a positive model of observing children. This study of my own child, although highly subjective, meant I could study her at home unobtrusively. As a study of one child's development of number we cannot generalise or claim that every child goes through the same development. However, a single child study can give pointers for observing other children. I observed Sovay from 20 months old until 38 months. I will highlight a few of the significant outcomes and discoveries of this study (Carruthers. 1997) . Before she was 31 months space and shape dominated my recordings but as Sovay acquired fluent speech I became fascinated by her talking numbers. By the age of 3 years 2 months Sovay had used number in nearly every area of mathematics in meaningful and purposeful contexts. She used a variety of numbers “none” to 100. She talked numbers many situations:

- playing hide-and-seek;
- reading numbers on the remote control, the radiator, a time clock and a calculator;
- counting money, large and small coins, in her own way: 1p, 50p, 51p, 52p, (coins did not match counting);
- initiating her own race, counting numbers “1. 2. 10”;
- singing number songs;
- counting the letters in words;
- using half and knowing it was less than 1;
- shopping and measuring.

Links with reading

Don Holdaway (1979) in his studies of pre-school children's reading development referred to the early learning children achieve as a “literacy set”. The children he studied had a good sense of what reading was about. They behaved in reading-like ways as they attempted to “read” books independently. The children knew that reading had meaning and made sense of the stories they “read”.

As Sovay talked numbers it was quite evident that, as in Holdaway's literacy set, she was making meaning of her mathematical number world, using numbers in meaningful contexts as she had seen her family and friends do. She was able to re--enact the mathematics as children re-enact stories they know through “reading” books. At 2 years 8 months she re-enacted a measuring scenario using a streamer as a tape measure. She put the tape measure round her father and declared it was “6” as she looked down at the numbers. Two months previously she had watched and listened to her grandmother making a dress for her sister and had re-enacted this kind of mathematical behaviour. As I traced Sovay's development I could see a mathematical set developing: the ability to tune in with appropriate action.

Mathematical Set

Children who have developed a mathematical set have the following abilities:

- are aware that numbers have meaning in all mathematical areas and engage with numbers in a meaningful way;
- use numbers to talk in context of their own lives;
- know that numbers can be written down but use their own written symbols;
- play with numbers making up their own idiosyncratic games;
- know that the numbers have written symbols though may not know what they are;
- know that numbers can be used m different ways;
- have started to develop their own number system with notable conventions of number.

Links with writing

Sovay's number development was very similar to the way children develop writing skills. At first her number engagement seemed as unobvious as the once overlooked “scribbles” of children's writing. However a pattern emerged. At first 2 and 6 were predominant in her talk. She seemed to be thinking about 2. developing conceptual knowledge. checking her hypothesis. In her counting she used 1, 2. t. 2. a repeated pattern to count any amount of objects but in other number situations she used 6. For example when asked the time Sovay. would always say "6 o'clock". She was making a clear distinction between counting and other uses of number.

Clay (1975) collected samples of early writing from children. Her analysis showed that they began with gross approximations, making letter shapes that gradually became letters. put together to make words and sentences. They also began by drawing letters in very personal ways. The letters in their name, for example, were very important to them. Sovay's age is very important to her - she points to 3 and says "That's me. I'm 3". These principles match well with Sovay's acquisition of numbers.

The parallel between Sovay's oral number development and writing development is quite striking. Just as letter knowledge seems to expand outwards from particular knowledge of a few letters, number development appears to take this form also. In both areas, language and number, very young children try to find a system and fit new information into that system resulting in unconventional writing or mathematics which has context meaning for them.

Gelman and Gallistel (1978) support the idea that children's acquisition of number has definite links with the development of language and indeed any subject- There is a definite scheme to their learning as in language - children self-correct, rehearse and have a definite rule--governed system.

Clay (ibid) comments that adults (including teachers) seem unaware of these vital stages of development and ignore these jumbled sets of letters in early writing. Only when children present writing in an easily read form are they prepared to recognise it. As her mother I find it delightful that Sovay chooses number 6 for every mathematical situation at one stage and counts 14, 19. 16, 17, 18. 14. 10. 16. 99. 14. 18. 19, 14 for hide and seek at another stage. As an educator I find it rich with implications for how we could support young children's growing sense of mathematical concepts.

The question of pre-number

If we are to accept the idea that, like literacy. learning mathematics is a developmental process, then the concept of pre-number does not exist. Studies such as Ginsberg's (1977) have shown that babies are capable of number concepts. Numbers exist in the child's world from birth and they are gradually building up a meaning for number and how it fits into a whole pattern of life. The evidence from my study of Sovay confirms this idea.

Sovay was building up sophisticated patterns of number knowledge which were seen through her actions and talk. Her knowledge was built through her partial understandings. The atmosphere in the home environment was such that these approximations in number were recognised and supported and as a result she went on to build more conventional number structures.

Although she used matching and sorting (a traditional pre-number activity) this was observed as early as 23 months and came much earlier than the usual teacher-set activities in nursery and reception classes. The Durham Project cited in Pettitt and Davis (1994) stated that 'pre-number' activities such as sorting and matching have little relevance to the acquisition of number concepts in young children. The evidence of the Sovay study supports this theory. Sovay naturally sorted materials and matched as part of everyday social activity that adults had previously demonstrated to her. For example, at 22 months she matched cereal bowls to places or chairs. Awareness of numbers was noted as early as 20 months. It would be misguided to ignore this and concentrate on 'pre-number' activities until she was “ready” for number concepts.

Implication for practice in early years setting

The study revealed the use of real life cues to develop mathematical knowledge. Sovay gained knowledge from adults and children who accepted and supported her gross approximations of number. The physical and psychological environment were important in her development.

An outcome of this study has implications for the kind of opportunities we should be providing in nursery and reception classes. Young children need to be supported in environments where:

- the level of expectation is high;
- there is a balance between mental and practical mathematical activities;
- the observations of children's mathematical language can form a basis for planning;
- adults provide a model and demonstrate mathematics as they 'talk numbers' to and with the children;
- there are lots of visible numbers in purposeful contexts - children's and sibling's ages, clocks, thermometers, calculators, raffle tickets, telephones and real money;
- children's curiosity and fascination with large numbers is supported and developed;
- the writing area has mathematical equipment - rulers, numbers. calendar, number line and measuring tape;
- children's approximations in number language are accepted;
- families are seen as important in the child's acquisition of number knowledge and the dialogue between home and school is open;
- role play areas support number development - receipts and till in a cafe. bus tickets, timetables, passports in a travel agency;
- assessment of young children's number knowledge is based on their mathematical set.

Conclusion

This research supports the view that there are strong links between the development of literacy and numeracy. If these two subjects develop along the same lines, then mathematics can be taught in a similar style to literacy.

References

Cambourne, B. (1988) The Whole Story, Ashton Scholastic. London.

Carruthers, E. (1997) The Pattern of Children's Number - A Developmental Theory, M.Ed Dissertation, University of Plymouth (work in progress).

Clay, M. (1975) What did I write? Heinemann. London.

Davis, A. and Pettitt, D. (1994) Developing Understanding in Primary Mathematics, The Falmer Press. London.

Ernest, P (1991) The Philosophy of Mathematics Education. Falmer. Basingstoke.

Ferreiro, E. and Teberosky, A. (1982) Literacy Before Schooling, Heinemann. London.

Gelman, R. and Gallistel, G. (1978) The Child's Understanding of Number. Harvard University Press, Cambridge MA.

Ginsberg, H. (1977) Children's Arithmetic: the Learning Process, Van Nostrad. New York.

Goodman, K. (1968) The Psycholinguistic Nature of the Reading Process. Wayne State University Press. Detroit.

Holdaway, D. (1979) The Foundations of Literacy. Ashton Scholastic, Sydney.

This research was part of an M.Ed Dissertation (Carruthers, E. 1997) at the University of Plymouth