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A pattern of children’s learning in number – a developmental theory

Mathematics Teaching. 162. March 1998. pp. 15 - 17.

My hypothesis is that we are able to take some of the principles of developmental literacy and use them in mathematics teaching. To investigate my hypothesis I started a study of a young child at home. Many researchers in developmental literacy have observed how pre-school children had a certain pattern to their learning. The children initiated their own reading and writing and through this their schemas of literacy developed. This development then formed a basis for supporting children's literacy in school. My own study was a parent-child study: to get to the root of the child's mathematical development I had to have close contact with a child in an everyday setting. Young children do not perform on demand and I believe it would have been impossible for me to study a child at home if it had not been my own child.

Sovay was twenty-two months when the study began and the data was collected until she entered nursery school at thirty-eight months. The study, which had a broad mathematical basis, focused in the end on the area of number, because it was the data on number which was the most revealing. The most significant finding of the study was that before the age of three Sovay gained knowledge of numbers using a pattern which was similar to that used by the children to gain knowledge of writing. Sovay used numbers purposefully in every area of mathematics before she was thirty-eight months old. A mathe-matical set could be seen to be developing that was similar to Holdaway's (1) idea of a literacy set.

These findings have powerful implications for the way we look at mathematical learning. If we can say that children develop understanding of number in the same way that they develop understanding of writing and reading skills, then we can put forward a reasonable case to teach in a more developmentally appropriate way. There is already evidence in the form of recent studies that children do know a lot more about mathematics when entering school than is demanded bv the tasks teachers set for them. Pre--reading is an unhelpful concept in building our perceptions of the emergent reader and writer; in the same way it is likely that pre-number is an unhelpful concept also. Indeed, in the parent-child study previ-ously mentioned, there was never a time when that child was in a 'pre-number state'. From the start of the observations when Sovay was twenty-two months old she was already using numbers. I believe that she was synthesizing knowledge about numbers, just as children synthesize knowledge about letters and writing at a very early age.

The teaching and learning

The study of my own child as a developing mathe-matician has obviously influenced my own classroom practice. I am now more able to accept children's gross approximations in their own number inventions. This gives me an indication of the level of their learning and how to support them. Increasingly, larger and more interesting numbers have been the source of whole-class projects. I have seen that children are building concepts about smaller numbers through their work with larger numbers: thev see a whole in number and a context to learning, just as children learn better when they are given a whole book to read rather than bits, or parts of words. In the last fifteen years more mean-ingful texts and a wider variety of literature have been made available to developing readers. This also needs to be the case in mathematics. In my teaching I have also been aware of other aspects of develop-mental literacy and seen parallel threads that can be used in mathematics. The Emergent Mathematics Teachers' Group has compiled a useful list (see below) that I used at the start of my journey in teaching mathematics in a more developmental way.

Emergent strands
the environment
self-initiated learning
the teacher's role
children and teachers taking risks
publishing
real books

parents and the community
developmental stages
quality literature
accepting approximations
co-operative learning
demonstrating/modelling literacy
recording
meaning
sharing work
choice
child-watching/observing
record keeping
planning for emergence
purpose

A source for understanding mathematical learning

If we are to look at very young children and agree that they do develop their own patterns for learning in mathematics, then this implies that the teaching of mathematics should have a bottom-up approach. In short, the young developing mind is our light on mathematics education. This proposition would, of course, make things uncomfortable for those at the moment who are seen to be at the top of the mathe-matical hierarchy, such as the pure mathematicians in universities. Mathematics as an academic subject is structured differently from the way children learn it and I believe this has led to confusion in the teaching of mathematics. As teachers we have been guilty of failing to take our own knowledge of how children learn seriously. Perhaps because we have felt an inadequacy within ourselves, we have listened too much to the mathematicians and resorted to a approach based on schemes.

A challenge for the future

Over the last seven years, with the support of the Emergent Mathematics Teachers' Group and through studying my own child, I have listened to and really observed children without the blinkers of looking at mathematics before looking at what children can do. I have put my own skill as an educationalist first and come to challenge certain traditional views about mathematics education.

- I challenge the use of pre-number activities.
- I challenge putting subject knowledge before children's own development of mathematics.
- I challenge the hierarchical nature of mathe-matics education.
- I challenge the emphasis on right and wrong answers.
- I challenge the place of conventional symbolism in young children's mathematics.
- I challenge the fact that one of the most influen-tial reports on mathematics education during the last thirty years, the Cockcroft report, looked only at school-age children. By deliberately leaving out the pre-school years it failed to see their significance in shaping our ideas about mathematics education.
- Lastly I challenge you as teachers and educators who are closely linked with children to help support what I believe is a wave of change in mathematics education. The change can only continue to thrive if teachers, parents and others vvho have influence and foresight support it at the grass roots to help children become confident mathematicians.

Reference

1 D Holdaway. The Foundations of Literacy, Ashton Scholastic, 1979

This article is based on an M Ed dissertation: Carruthers E., Young children's number: a developmental theory - a case study of a child from 20 months to 42 months.