



National Teacher Research Panel

engaging teacher expertise

This summary was commissioned by the National Teacher Research Panel for the Teacher Research Conference 2004, which explored and celebrated teacher engagement in and with research. All conference materials are available at www.standards.dfes.gov.uk/ntrp

A multi-sensory approach to teaching mental arithmetic

Aims of the project

The focus of this teacher-led action research was to construct a programme of multi-sensory teaching activities to develop mental arithmetic capability in children from Nursery through KS1.

Context

The study took place in an Infant School on the South Coast of England, serving a mixed catchment area with one in three pupils on the special needs register.

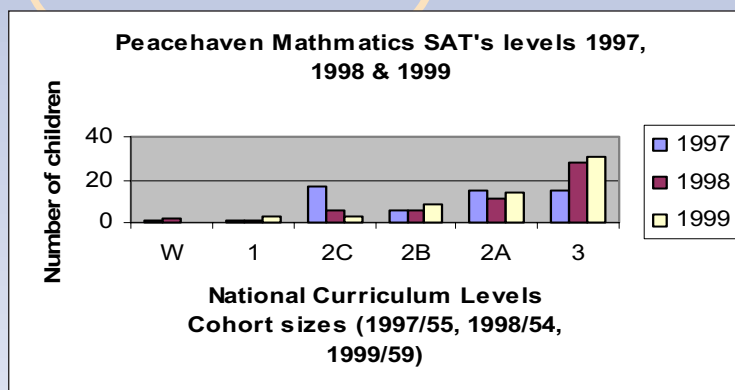
Teachers in the school in collaboration with the University Of Brighton School Of Education carried out a Teacher Training Agency (TTA) Teacher Research Project during 1996-7 to begin to construct in Reception and Year 1 an effective programme of multi-sensory arithmetic activities. An extension of the project in 1997-8 enabled the activity programme to be extended from Nursery to Year 2.

Since the original study there have been further research developments carried out by Brighton EAZ, Bristol Learning Support Service and Downs Educational Trust, investigating the effectiveness of the teaching activities for children with various special needs including Down Syndrome.

Summary of main findings

- Children whose arithmetic had been supported using visual structured imagery during the research project showed a dramatic improvement in attainment in KS1 SATs 1998 in comparison with the results of the previous cohort (1997) whose learning had not been supported by visual structured imagery. Since the study similar levels of attainment have been sustained year on year at the school.

Figure 1



- The programme of teaching activities helps to meet the early learning goals of the Foundation Stage and the KS1 objectives of the National Numeracy Framework.
- Children were drawn to the apparatus and used its structured patterns to show their understanding of number and arithmetic.
- Teachers found the programme of activities easy to follow and found it easy to assess children's understanding by observing and listening to children's explanations as they used the structured apparatus.

Background

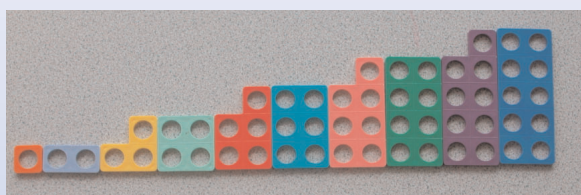
Peacehaven Infant School has a two form entry with 180 pupils on roll plus 25fte nursery class, one third of its pupils is on the special needs register and just over 20% of children qualify for free school meals. Baseline assessment results show many children enter the school with poor language skills.

Prior to 1997 in teaching successive classes we had been aware that many children had not substantially mastered arithmetic. We had used various published mathematics schemes all of which relied on counting as the basis for arithmetic and moved children very quickly from counting towards formal symbols in mathematics. Some children were able to arrive at correct answers without necessarily knowing why. We had felt schemes put an artificially low ceiling on teacher expectations for some children.

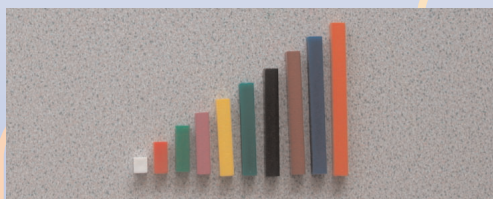
The serendipitous discovery of a copy of Catherine Stern's book *Children Discover Arithmetic* led us to challenge our pedagogy and explore the use of the visual images originally used by Stern within a structured programme of teaching activities we developed during the project. The activities used shapes and rods and encouraged children to develop a systematic mental imagery of number, to develop mathematical language and to apply their arithmetic to real life problems.

The structured images which we used are shown below:

Shapes



Rods



We wanted children to develop an understanding of number that relates numbers to each other (relational understanding) which could be generalised to solve new problems. Previous methods of solving arithmetic problems by applying learnt procedures and falling back on counting when they met a new problem did not seem effective.

Our research coincided with the publication of the National Numeracy Framework which emphasised mental arithmetic strategies and set high expectations of children's achievement. Paradoxically the Framework did not give specific emphasis to direct teaching of relational understanding and avoided the use of visual structured apparatus, although it expected children to employ relational understanding in mental arithmetic