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New teaching equipment has made a big difference to one school's results, as Victoria Neumark reports.

The figures speak for themselves: in 1997, 27 per cent of children at Peacehaven Infants school achieved level 3 in key stage 1 maths. In 1998 and 99, 52 per cent did. With boys, the jump was even greater - from 32 per cent to 63 per cent. Such progress is extraordinary by anyone's standards. So what has made the difference?

Headteacher Romey Tacon has a dedicated staff and pleasant buildings, but so do many infants schools. Despite its location, nestling in the green Sussex downs by the sea, Peacehaven serves an area with its share of social problems. Though the school is yards from the beach, each year children enter reception having never been near the sea. Thirty-five per cent are on the special needs register; 21 per cent qualify for free school meals; less than 5 per cent of parents have had further education.

Romey Tacon has been at the school since September 1995. From the spring of 1996 until the summer of 1998, Peacehaven and Mrs Tacon were involved in pilot research projects on mathematics teaching funded by the Teacher Training Agency (TTA). These were based on the work of 1930s psychologist Catherine Stern, whose book, Children Discover Arithmetic (1949) focuses on the difficult transition from counting objects (apples, oranges) to manipulating abstract numbers.

Believing that "children should not be held back at the primitive stage of counting objects", Stern developed classroom equipment to facilitate the growth of abstract mathematical thought. When Mrs Tacon first came across Stern's work, it was, she says, "like switching on a light bulb". The children who entered Peacehaven in September 1996 were the first to follow a maths programme based on Stern's work. They were the first to show extraordinary results. Those results were sustained this year by children who in a Year 2 classroom this summer, were roaring with laughter as they played maths games, avidly writing down calculations and confidently reaching for ever more complex mathematics. It's not just the test results that speak for themselves, it's that the children say things like "you can do it two ways", and "Nah, you gotta go diagonal", with the confidence born of secure understanding.

Romey Tacon first came across the work of Catherine Stern in 1993. She was discussing children and maths with Dr tony Wing, her former tutor at Brighton University. He brought in old Triman apparatus, an early product embodying Stern's structured images of number.

In her teaching practice, Mrs Tacon had been worried about how children could move from counting to number bonds. What about odds and evens? How could she get across the cummutativity of addition and multiplication (2+3=3+2, 2x3=3x2) but the non-commutativity of subtraction and division (3-2, 2-3, and 3÷2, 2÷3)? Even more basic, how do you get across the notion that adding one to a whole number always produces the next whole number in the series; that seriation is a general principle, not an experiment in buying fruit?

It was obvious to her that many children found the abstract representation of number very difficult, a difficulty she became convinced was linked to their developmental stage. And with children from deprived backgrounds, development can be delayed in any case. "My concern, says Mrs Tacon, "is that we are asking the youngest children to think in the abstract too early. We don't ask them to learn to read without pictures. We need to give them structured pictures for number, that exploit their natural sense of pattern and take them into the world of number."

The TTA-funded project used Numicon with more than 200 teachers. It's a set of classroom equipment based on the work of Catherine Stern and developed with advice from Tony Wing. In the traditional arithmetic teaching, children learn to count objects, then to add by counting, then to count on a number line, then to "count on" with bigger numbers. From this, number facts are supposed to be devised. This infrastructure also underpins part of the National Numeracy Strategy (NNS).

But it is not, says Mrs Tacon, the most child-friendly way of doing things. No one is questioning that children need to learn to count, but is counting the best route into arithmetic? Counting is no more sufficient for mathematics than knowing the names of the letters of the alphabet is for reading. Mathematics, with its number facts, multiplication tables, equations, formulae and place value, is a way of superseding counting and progressing to manipulation of pattern.

Catherine Stern used simple but structured images to bridge the gap between objects and our usual cyphers. Numicon, its sets of circles in coloured plastic, immediately tells you about sets and pairs: odd ones, like 3s and 5s, stick up; decades stack on one another; three threes will fit on a nine.

The old gestalt psychology - developed in the 1940s when Stern was working - explains how the mind has an urge to see wholes. An odd number sticking up creates an urge to "round off", to make it even. The lone circle poking above three sets of two seems to be looking for a mate: "Seven seeks one to make eight". But does writing "7" make one want to write "8"? Likewise, subtraction can be clearly seen by laying the plate representing the lesser number over the greater: the patterns leap to the eye. Max Wertheimer, Stern's mentor in the gestalt group, wrote that we "learn by insight, look for completion and make sense of our world by looking for pattern".

Many primary-school theorists and teachers may worry that children become too reliant on the images and fail to abstract the concepts further. But this doesn't happen, says Romey Tacon. "Children," she says, "like to work efficiently." Ruth Atkinson, maths co-ordinator at Peacehaven, agrees. "Everyone loves using Numicon, because it works, " she says simply. Numicon also lends itself perfectly to learning and using mathematical vocabulary, essential in plenary sessions The Numicon system starts in nursery, where the three and four year olds are eager to have their turn with the shiny plastic plates. they learn to place numbers in order and assign number values, first verbally and then with bright shiny cards printed with the actual numerals. In developing the idea of addition, they look at how numbers build. In reception, Numicon is used for addition, subtraction and number bonds within 10, with reference to the NNS.

In Year 1, numbers go up to 100, with much use of mental maths and strategies of rounding up and down. In Year 2, children begin to move off into the higher reaches of number facts, multiplication and division, now only using Numicon if they feel they need it.

Progress in reception and Year 1 can appear slow. "We can meet all the outcomes," says Mrs Atkinson, "but it takes time for children to secure understanding." In the early stages, pupils may appear marooned between 10 and 20, but really they are gathering mental forces for a leap onto the abstract shores of Years 1 and 2. "Children learn opportunistically," emphasises Mrs Tacon. "So maths has a high visual profile here." The school is full of colourful maths displays, with constant mention of structure and resolution.

The staff also feel that placing maths at the core of the school's learning has an effect on the children's general behaviour. "Working with Numicon has a calming effect on difficult children," says Mrs Atkinson. "Children are drawn to the images and work with them in a focused way." Perhaps it is not just the equipment, but the general exemplification of successful thinking: over and over again, Numicon helps the children get it right and know what it means.

Whether in reception, where the children are counting seahorses - "We didn't have to count it," beams their teacher Jason O'Donnell, "we just knew" - or in Year 1 where Conor wants to tell everyone, "I done all of them and I got them all right" - or in Year 2 where the announcement, "We're going to add on 8s now," is greeted by air-punching cries of "Yes" - it's clear that Numicon adds value. The figures do speak. Maybe it's time for the country to listen.

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