

THE ROLE OF NUMBER RESOURCES IN THE DAILY MATHEMATICS LESSON

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This article is based on interviews with Key Stage Two teachers about how they use number resources. It concentrates on one resource advocated by the Numeracy Strategy, the number line and one resource which now has a lower profile, base ten blocks. Particular attention is paid to the use of resources in teaching calculation. Findings show that most teachers make use of the number line, often to teach calculation. Base ten blocks are used for teaching calculation by some teachers, though about half make no use of them. However, closer analysis suggests that teachers have different levels of understanding both about how number lines might aid calculation and about the place of standard written methods of calculation.

BACKGROUND

One high profile feature of the National Numeracy Strategy and the associated daily mathematics lesson has been the use of number equipment or props. Such props have featured heavily in training videos and have been made commercially available and widely advertised. They reflect shifts in popular methods for teaching calculation, as well as reflecting the type of activity deemed appropriate for the daily mathematics lesson. Conversely, some types of equipment feature less in current materials than they have in the past and are considered to be less in keeping with the Numeracy Strategy approach. This article considers one resource which has become more prominent, the number line, alongside one which has become less prominent, base ten blocks.

Base ten blocks were first introduced by Dienes alongside blocks in other bases and accompanied by detailed instructions. Base ten blocks were seen as a physical representation of means of calculation, particularly the ‘exchanging’ which was said to underlie standard methods of column addition and subtraction, in particular the ‘decomposition’ method of subtraction. For many years decomposition and associated pictures of base ten blocks dominated British primary mathematics schemes. However the decomposition method was not without its critics (Plunkett, 1979) as was the assumption that children could make the link between physical manipulation of the blocks and the pencil and paper procedures they were said to be related to (Hart, Johnson, Brown, Dickson and Clarkson, 1989).

As the teaching of number in Britain came under growing scrutiny, (SCAA, 1997) there was a decline in the popularity of methods based on single digits and the early emphasis on standard written methods. Instead there was enthusiasm for mental methods and methods which treated numbers holistically rather than digit by digit. It was still acknowledged that base ten blocks may have a place in teaching mathematics, but it was much lower profile. The framework for teaching mathematics

(DfEE, 1999a) suggests that base ten apparatus can be used to demonstrate the partitioning of numbers, but warns that children may learn to manipulate the blocks without transfer of understanding and suggests that digit cards should always be used alongside them. The use of blocks as an aid to calculation is not advocated either in the framework or in the accompanying book about teaching written calculations (QCA, 1999b)

In contrast, number lines have a higher profile in the strategy. They are the first piece of equipment mentioned in the resources section of the framework, which says each class should have a large number line. It also talks about the provision of number lines for individual use and discusses the different types of number line which can be used by different ages. Number lines also feature in the training materials (DfEE, 1999b) which advocate their use by the teacher for demonstration purposes as well as by individual children. Examples given include the use of a number line to demonstrate subtraction as difference and as an aid in using the method of bridging through ten when adding. The booklet on teaching mental calculation strategies (QCA, 1999a) gives further examples of the use of the number line in developing mental strategies. This includes use of the empty number line, in which there has been increasing interest, stemming from its use in the Netherlands (Beishuizen, 1999).

METHOD

This research forms part of a longitudinal project on mathematical tasks being carried out in five schools. This phase of the research consisted of interviews with thirteen key stage two teachers drawn from the five project schools. The interviews were held towards the end of the first year of implementation of the National Numeracy Strategy. Teachers were shown number resources and asked if they had used them with their current mathematics set. Those who had used them were asked about the version of the resource and how it had been used. Those who had not used them were asked why. This article considers teachers' responses to two of the resources used, number line and base ten blocks.

FINDINGS

Overview

Most teachers had used number lines with their class or set in the current year, while less than a half had used base ten blocks. In both cases the resources had been used either for calculation or as a model of the number system. For the purpose of this article, the focus will be on using the resources for calculation.

Five teachers indicated that they had used number lines, but not blocks, as an aid to calculation. Two had used blocks, but not number lines and two had used both. Closer examination of the responses of these nine teachers sheds some light on their views of the two resources and of their methods of teaching calculation.

Number line users

Five teachers indicated that they used number lines, but not blocks, for calculation. There was variation in the detail in which they talked about their use of the number line. Four out of the five were emphatic about not using base ten blocks, while one explained that she no longer used them for calculation, but did use them for explaining the number system. All five showed some awareness of current approaches. Mary, a mathematics co-ordinator and leading maths teacher talked in the most detail about use of number lines:

...especially when first doing mental maths and talking about calculating. We play 'make a hundred' to secure number bonds. If it's 53, use the number line to show them it's 7 to 60 then 40 more. So work it quickly in heads ... do on board, then close eyes, put in heads and do it as mental imagery. (Mary, Y6 middle set, number line)

In contrast Mary did not see a use for base ten blocks and she explained why:

No. I suppose because I use arrow cards. Children can actually see from the arrow cards easier than they do from ... and I'm more familiar with arrow cards and can do more with them. I've never really played with these since university. (Mary, Y6 middle set, base ten blocks)

Linda, an experienced teacher who works at the same school as Mary talked more briefly about use of number lines. However she was more detailed in her explanation of why she had changed her use of base ten blocks.

...mostly for adding and taking, when you're getting on to higher numbers. (Linda, Y3 bottom set, number line)

Yes, use those for tens and units ... for splitting numbers into tens and units, making the numbers... I've used them a bit for addition, though less so now, because we're not – in year three we don't do the addition downwards, though I have said you can use them to help you, it's not quite the same ... It's better actually to use a number line and count on than to set out your Dienes in tens and units when we're not actually doing the adding formally in columns. (Linda, Y3 bottom set, base ten blocks)

There were three other teachers who had used number lines but not blocks for calculating. They showed some awareness of which approaches were currently advocated, but it was not clear whether or not they understood the rationale behind changes of approach.

Yes, for anything to do with counting on, different ways of addition and subtraction ... stepping stones. (Heather, Y3 top set, number line)

No ... can't get to grips with them that much ... not enough hands! I haven't seen anybody using them really well. I think if I did, if somebody demonstrated to me how to use them properly, I might do it. But, no, I don't tend to use them. (Heather, Y3 top set, base ten blocks)

...mainly for addition and subtraction. (Sally Y3/4 top set, number line)

No, not with top set, maybe with lower ... don't particularly like them, don't see the value of them. I think these have lost their potential now ... There are other methods now. (Sally, Y3/4 top set, base ten blocks)

...every other day in the mental and oral bit, for counting and tables... (Carol, Y5/6 bottom set, number line)

...don't tend to teach that way anymore. Probably when I started teaching I did, hundreds tens and units, decomposition . Now I just don't work in that way. (Carol Y5/6 bottom set, base ten blocks)

Line and block users

There were two teachers who used both number lines and base ten blocks for teaching calculation. The quotations below show the advantages of both resources, as perceived by these teachers.

... big number line for teaching addition ... useful to show jumps. (Angela, Y3 middle set, number line)

I have used them more actually to show ... number system, that ten units make... Then we used them when we started adding ... recorded like sticks and dots. (Angela Y3, middle set, base ten blocks)

... used for adding on, taking away, reinforcing number bonds. (Paul, Y5 bottom set, number line)

...very good for addition and more so for decomposition ... let them see it's a hundred. (Paul, Y5 bottom set, base ten blocks)

Base 10 Block users

Two of the teachers used base ten blocks but not number lines for calculations. The comments below suggest that both teachers were still teaching standard written methods of calculation, which could be modelled by the blocks. One of them was aware that use of blocks was less widely advocated now, though it was not clear whether he understood why.

Yes, especially when we've been doing – if we've been doing subtraction or addition. We've been looking at exchanging and things... used them a lot. (Greg, Y4 top set, base ten blocks)

Back to basics... What's division? What's multiplication? Show them how to do it...still have problems with place value...what place value means...Those probably to me are still... and people tell me these are all out of date and rubbish, but then, so ...(Luke, Y6 middle set, base ten blocks)

DISCUSSION

These nine teachers show variation in the way they use equipment to teach calculation and in the way their practice matches the detail and apparent intention of the Numeracy Strategy. Mary's discussion of both number lines and blocks indicates

that she uses number lines in a way similar to that advocated by the strategy. Linda shows a similar understanding and also raises the important point that choice of material to teach calculation is likely to be linked to the method of calculation taught. These two teachers were extreme examples in exhibiting this degree of awareness.

Three teachers showed some understanding of what was expected and what was no longer encouraged. Two of these, Carol and Sally, gave short answers, especially when talking about the number line. It is not possible to tell whether they did in fact have an awareness of the reasoning behind changes in equipment advocated. The third teacher in this category, Heather, was slightly different, in that she was in her second year of teaching and, unlike Sally and Carol, had never used base ten blocks. Heather's suggestion that she would use blocks if she had seen them used well, coupled with a comment made later in the interview, that she had learnt a lot from demonstration lessons from the co-ordinator, suggested that she was reflecting current practice without necessarily understanding why. Other teachers also suggested that there was an element of 'fashion' in what was and wasn't done and only Luke openly challenged this.

Four of the teachers seem to be operating in a way contrary to some of the detail of the Numeracy Strategy. All four are continuing to teach formal column methods of addition and subtraction, including decomposition aided by base ten blocks. Two of the four do talk of using number lines for addition and subtraction, but it seems they do not mean this in the way the Numeracy Strategy does. Both of them seem to see number line addition and subtraction as an early stage, for dealing with small numbers. This is supported by comments made later in the interviews. Angela, for example says the children use individual number lines more at the beginning of the year. Paul admits that the co-ordinator wants him to stick number lines on the tables, but he feels this may hold the children back. Discussion of the type of number line used confirms that both teachers use number lines with individual numbers marked on them as an aid to adding single digit numbers, something that they hope the children will move away from soon. They are not talking about developing mental strategies with the aid of an empty number line, as advocated by materials associated with the Numeracy Strategy.

CONCLUSION

The interviews suggest that resources such as the number line, which are associated with the Numeracy Strategy, are being widely used. For about half the teachers interviewed this was coupled with a lack of enthusiasm for pre-strategy resources, such as base ten blocks, which were seen as out of date. However, a closer look at responses suggests different levels of understanding about what might be involved in calculating with a number line. There are also different views about the use of standard written methods of calculation. For some teachers it appears, the Numeracy Strategy has led to major changes in their teaching. For others, although they have

made changes such as putting number lines on the wall, their approach to teaching calculation continues as before.

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