Moving into compact methods of calculation – procedure versus conceptual understanding.

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SBP Sharing Best Practice

Key Points

- Compact methods sooner?
- Procedure versus conceptual understanding

Purpose

What were your reasons for doing this development work?

With the new curriculum and lessons from Shanghai promoting more compact formal methods sooner, and less emphasis on expanded methods, we wanted to explore how and whether it was possible to have more children working sooner and securely with compact methods of calculation, specifically in multiplication.

This is of interest to anyone reviewing their calculation policies in the light of the new mathematics curriculum.

At a recent Maths Mastery conference, one of the challenges presented to us by Shanghai teachers was the age and pace at which our pupils reach traditional compact methods of calculation. Whilst they endorsed our use of concrete apparatus and expanded methods they argued that we British teachers let children become too comfy with expanded methods and apparatus and that we should move them on more quickly to the goal of compact methods. We wanted to investigate this claim.

Who were the identified target learners?

Our focus group was in Year 5, and in particular, those children who were not secure in the methodology, but who we felt had the requisite mental skills i.e.an understanding of partitioning and place value and fluent recall of times tables. We wanted to really look at both our teaching towards compact methods – how could we support conceptual understanding rather than just teach a procedure – and to observe their learning: what is it that is stopping them doing this method confidently and securely?

Our success criteria was that more children would be able to use the compact method with confidence and understanding.

At the start of unit – 8/30 children were confident with the compact method and using it fluently and with automaticity.

What were your success criteria?

- More children to be using the compact method with understanding and confidence;
- More children to be experiencing repeated success with the compact method.

What did you do? (What success criteria did you use?)

Methodology

Our staff are very used to working alongside members of SLT; one of our main induction processes is 'parrot on the shoulder coaching' where we give real-time feedback during a lesson. We used Lesson Study, pairing up our headteacher, Year 6 teacher (NQT) and Year 5 teacher (2nd year teacher) within the Camden Lesson Study Project . We planned a series of lessons together, centering on an analysis of teacher modelling and 'intelligent practice'. Based on Variation Theory (Ling and Marton 2011) , this is about choosing repeated practice examples to focus the learner on small changes that reinforce the concept.

Sequence of lessons broadly:

Rounding and estimating;
Revise expanded grid method;
Introduce a vertical method we coin as 'sandwich' : the 4 parts of the calculation are presented in vertical layers;
Introduce compact method.
A culture of error is integral to our teaching and lessons began with 'spot the mistake' modelling:

With the place value so explicit as in the expanded method, all children could quickly see what had gone wrong. It was immediately apparent that this was less true in this compact example where the place value is implicit. *See attachments.*

As the sequence of lessons progressed, and after daily marking and discussion, children were re-grouped so that the next day there was purposeful (intelligent) practice of worked examples at the right stage for them. Teachers gave great thought to the fine steps in the calculations set in terms for example, of numbers of digits, the appearance of zeros to test conceptual understanding. Calculations were always presented horizontally so that children 'read' the calculation rather than went into a procedure. To this end we integrated calculations such as 20 x 53 and 11 x 62 expecting children to use efficient mental strategies.

Those children already secure with the compact method worked on deepening their understanding of the concept by working on problems . *See attachments.*

At all stages the focus group of less secure children were observed by one of us.

What specific teaching resources did you use?

Teaching resources

We used place value counters, both real and on screen, to model the concept of long multiplication. We had presumed, that as in many areas of maths, equipment would support the less able but our observations showed that, in this case, it didn't. The focus group didn't need it: they knew their tables and their place value was secure. Whilst modelling on screen made the place value clear, the children were slowed down gathering place value counters themselves.

The main teaching method was whole class modelling with Individual whiteboard responses and then flexible groupings working on intelligent practice with careful planned variation. Models such as those shown in the attachment were worked through as a class:

It seemed apparent that we needed to make the links between each method more explicit. We decided to begin modelling with a 'split screen' linking the method to expanded methods; working through the same calculation in the 3 methods. *See attachment.*

This meant for example, that the convention of putting a zero in the second row of a compact calculation, (presented to many of us as children simply as 'lay an egg'!) could be clearly explained and linked to the expanded method.

Outcomes and Impact

What has been the impact on pupil learning and teaching?

Impact on whole school.

Outcomes and impact

We noticed that a child could be very successful and confident with an expanded method and then become totally confused with the compact method.

We observed that the 'split screen' really helped. Children could see where different components – so clearly visible in the expanded method – were 'hidden' in the compact method.

However despite hooking all the class into the compact method each day, our focus group of 3 still struggled.

The majority of the class moved securely through all the stages and by the end of

the series of lessons, were using the compact method fluently and successfully: 25/30. However, the focus group, who demonstrated real success and understanding with both the grid method and our vertical ‘sandwich’ method, faltered on the compact method. It was quite striking how confidence was lost and errors were made.

Children’s feedback was:

“We can’t see what we are doing.”

“We get lost.”

“If you get distracted you can’t remember what you just said.”

And all expressed a very clear preference for the grid method.

What we observed was that one of the main reasons that this group were below average was not lack of mathematical skills: all knew their tables fluently. They were all highly distractible and displayed a poor working memory. The abstract nature of the compact method requires focus: and a ’straight run through’! With the expanded methods they were supported so much better in working through the procedure. If they lost focus doing a compact calculation, they couldn’t see ‘where they were up to’ whereas the highly structured and visual nature of the expanded method offered great security that they would get it right. The children were unequivocal that this was their preferred method. And it was a method that they experienced repeated success in.

With the expanded grid method place value is explicit and any errors are immediately visible. With the compact method, the place value becomes implicit and it becomes much harder to ‘see where you are’ or identify errors.

Evidence of impact on pupil learning and teaching/leadership