SACRED COWS

Mike Ollerton suggests that effective teaching must challenge some 'sacred cows' which are accepted orthodoxies.

Over the past three years I have spent a good deal of time in primary classrooms, working with teachers on problem solving approaches to the teaching and learning of mathematics. I have also worked part-time on an initial teacher training course and an NCETM/Yorkshire Forward funded project entitled 'Inspiring Mathematics Champions'. Thus I have had the pleasure to work with both highly committed teachers and trainee teachers. However, during this time and through these experiences I have been shocked at the abundance of curriculum prescription in mathematics and at the amount of energy colleagues put into conforming to orthodoxies. Regrettably much of this time and energy serves to undermine children's learning of mathematics. I do not wish to be critical of schools and certainly not of teachers and trainee teachers. I am, however, sceptical and highly critical of some of the systems and accepted orthodoxies which appear to dominate what happens in mathematics lessons.

The issues and orthodoxies to which I refer are:

- the use, or the interpretation of, mental and oral 'starters';
- three-part lessons
- writing (narrow) objectives on the board;
- differentiation by (different) tasks;
- pace.

I explore each of the issues above with the intention of exposing the frailties of recent orthodoxies prescribed by… well, who I ask myself? I offer ways of constructively reinterpreting these orthodoxies in order to consider what alternative approaches to effective practice might look like.

Mental and oral starters

I believe it is important to help children to:

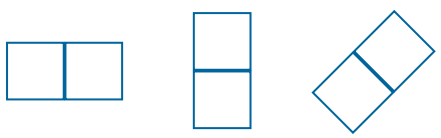
a) 'see' mathematics in their 'mind's eye'
b) communicate what they 'see' verbally.

I define seeing and communicating as ways of developing effective practice. However, I have two concerns, first that if mental and oral starters are an exercise in arithmetical gymnastics, supposedly to activate children's minds, then I believe this can undermine the confidence of some children, especially those who need time to work things out and achieve competence in carrying out mental calculations in isolation. This is because different children learn, and make sense of their learning, at different speeds and to different depths; this is related to 'differentiation' and to 'pace' both of which I develop below.

Secondly, if the oral and mental starter focuses on mathematics which is different to the main part of the lesson there is a danger of the teacher spending too much time 'teaching'; i.e. the teacher first of all introduces the starter, then has to provide another introduction to a different piece of mathematics. There are dangers, therefore, in children being reactive for too long in lessons in order to answer teacher-posed questions which frame two different areas of mathematics.

An effective use of a mental and oral starter is, I believe, as an introduction to the rest of the lesson – or even the next three or four lessons. A mental and oral starter can also be based on geometric imagery; for example I offer the following possible scenario.

Ask the children to imagine two squares of the same size. Then ask them to put these squares together joined whole side-by-whole side.
Question 1: "*What shapes do you have in your mind's eye?*"
Task 1: Ask children to explain to one or two peers what they saw *in their mind's eye*.
Task 2: Ask pairs/groups of three to explain to the class what they saw. Perhaps one child might draw what another child has communicated. I would expect three 'different' types of answers to emerge which would look something like:

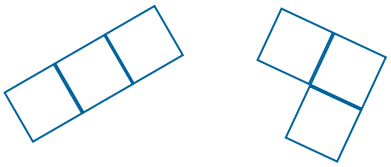


Some discussion may ensue about whether these shapes are the same or different, and this might lead the teacher introducing the word 'congruent'.

Question 2: "*Suppose we have three squares of the same size and we join them together whole side-by-whole side, what 'different' shapes do we see?*"

Tasks 3 and 4 can be repeats of tasks 1 and 2 above for the three squares.

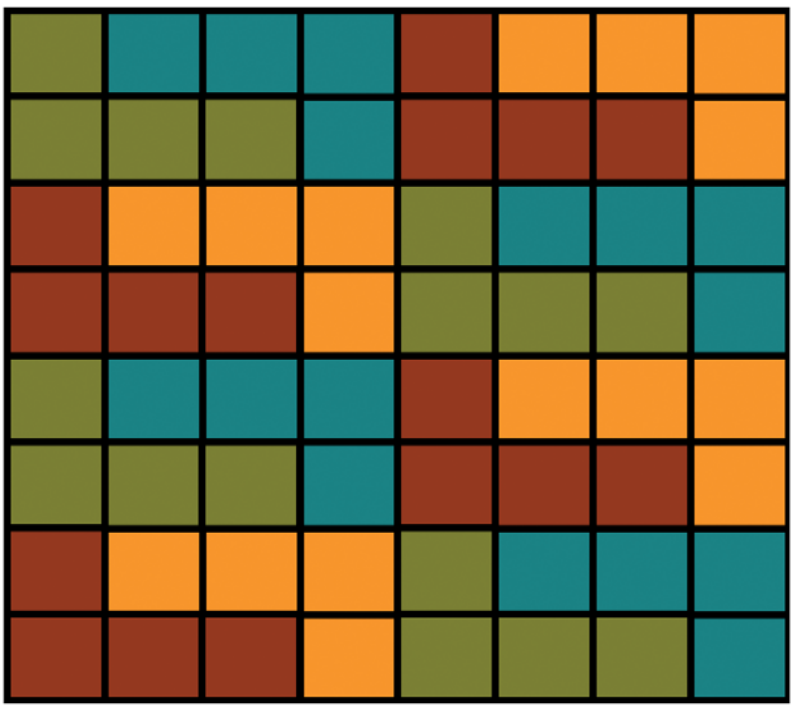
There are, of course, only two essentially different answers yet by drawing all the shapes the children offer this will provide a further opportunity to discuss and develop the concept of congruence.



Using this task as a 'starter' for the main part of the lesson, I may provide children with four squares and ask them to find all the different shapes using the same edge-joining rule.

Further tasks could be:

- How do 'you' know you have found all the different shapes?
- Draw in any lines of symmetry in the shapes you can see
- Make some tiling designs using repeats of the same shape made from 4 squares. An example using a shape from 4 squares is shown below.



- Find the perimeters of the shapes made from 4 and later 5 squares (if we count the length of the square as 1 unit).
- How many different shapes are there if we use 5 squares? These are called *pentominoes* and there are a sack-load of further problems which you will find by 'googling' pentominoes.

This example utilises a mental and oral starting task for children to access the rest of the lesson and possibly, the next three or four lessons. An important ingredient in this starter – main course recipe is that the introduction to the lesson need only require ten minutes of teacher input to the whole class. The implication is the children will have plenty of time to work on the task and any extension ideas they subsequently pursue.

By extending such a task over several lessons, different children will have opportunities to develop the work they do to different depths; again this is the basis of differentiation by outcome.

Three-part lessons

The only way a lesson might be described in three-parts is that:

a) the lesson will begin,
b) the lesson will end … and
c) between the beginning and the end something will happen.

If, however, in our planning we define all three stages then there are inherent dangers that, by hook or by crook, the teacher will feel it necessary to 'get through' their plan. The potential dangers here are:

- some children might only just have started to get to grips with the task they have been presented with when it is time to start the plenary; (I have some evidence of this from working with teaching assistants who have attended 5-day mathematics courses).
- something may happen during the 'main' part of the lesson which might be a more interesting avenue to pursue than was anticipated or planned-for;
- stopping the children when they are in full flow in order to carry out a plenary might be wholly inappropriate and will inhibit both their learning and the opportunity to develop the task further.

Surely effective practice must be based upon a teacher's autonomy to make professional decisions. This, in turn, is about the teacher deciding when to intervene, when to let something run, when to tear up the lesson plan, when to change an activity, when to talk to the whole class, when to organise some children to talk to the rest of the class, when to…

Writing narrow objectives on the board

I am wholly in support of the teacher either explaining to the class, or having a conversation about what she/he intends the children to work on. I believe sharing information is useful. Examples of a sharing, based upon the problem above, might be:

"*Today we are going to explore the different shapes we can make by joining squares together*", or

"*Today we are going to work on a puzzle which is about joining squares together*", or

"*Today we are going to do some imagining, some practical work, some drawing and some figuring-out, all by joining some squares together.*"

I urge us all to consider exactly what children gain by the teacher writing a specific, narrow objective on the board, often followed by the children copying this objective into their exercise book.

The following objective is taken from the Primary National Strategy:

Year 3 Block D – Calculating, measuring and understanding shape – Unit 2

Find unit fractions of numbers and quantities (e.g. ½, ⅓, ¼ and ⅙ of 12 litres).

What exactly does this objective mean to us as adults? I challenge you to write your answer before you refer to the rest of the unit plan. As adults we can look at the entire unit and see how this specific objective fits into the overall unit plan. But what, as a fragmented piece of information, might this objective mean in the minds of children aged 7 or 8?

The learning outcome, meanwhile states:

I can use division to find ½, ⅓, ¼, ⅕ and ⅙ of a measurement.

Could this mean: "I can use division to find a fraction with a unit numerator of the length of my left leg"? Well, actually, yes it could as I suggest below.

It is worth asking what purpose explicitly stating such a learning outcome might serve? More importantly, how are children going to 'feel' if, by the end of the lesson, they do not know how to *use division to find ½, ⅓, ¼, ⅕ and ⅙ of a measurement?*

As an alternative, offer the objective;

"*Today I am going to cut you lot down to size!*"

– then set up a task where you ask children to carefully take some (linear) measurements, height, arm length, leg length, distance between shoulders etc. Then half each measurement. Next ask them to make a half-size, or quarter-size, model of themselves using black sugar paper. What is certain is there will be plenty of measuring, halving (or quartering), active learning and enjoyment. At the end of all this activity and, if the scale pictures have been produced on black sugar paper, an interesting display can be created.

Compare this task with examples from the PNS:

Milly has a 100ml bottle of medicine. She takes one fifth of the medicine each day. How many days does she take the medicine for? How much medicine does she take each day? What calculation did you do to work this out?

John has a 120g bar of chocolate. He cuts it into six equal pieces. How much does each piece weigh? What fraction of the bar is this?

Narrow objectives lead to narrow, unimaginative and possibly boring calculations. Who are Milly and John?, and are the children really interested in the medicine Milly takes or a fraction of a bar of chocolate which John wishes to know the weight of?

A further issue stemming from providing narrow, specific objectives to the whole class relates to that of differentiated learning which I develop further below.

Differentiation by (different) tasks

Different children learn at different rates and to different depths. In every class there will be as many different rates and depths of learning as there are children in the room. We cannot avoid differentiation, nor should we wish to, and we most certainly cannot ascribe groups of children (usually three groups) as having or achieving similar rates and depths of learning. I have recently been introduced to a most disturbing notion whereby children are grouped according to spurious names of 'Must', 'Should' or 'Could' and then disingenuously calling them 'Maples', 'Sycamores' and 'Cedars' – yes there is an obvious mapping here. However I was stopped in my tracks when I saw the words 'Must', 'Should' and 'Cannot' which had been left on the whiteboard, paradoxically these words were there because the writer had used a permanent pen. These words/labels would not rub off, just as the stigma of being in the bottom (sorry, I mean the Cedars) group does not rub off for children.

By providing three different worksheets or three different tasks to three different groups of children, we are in danger of assuming that we know, at a micro level, what level of worksheet/task is appropriate for each child. However, children are changeable beings so we cannot know, or rely upon knowing, such information. Besides, what is the point of preparing three different, levelled resources when one rich, accessible starting point will enable differentiation to occur naturally; by outcome?

Taking either the 'squares' task or the 'cutting a class down to size' task, we can offer all children the same starting points; the key issue is the accessibility of the task to all children in the class. Because the task can be extended in a variety of ways and to different depths, the differing potential individual achievements can be catered for. Children can, of course, be encouraged to work in a pair or a group of three, although not a so-called 'ability' pair/group, and this will enable valuable discussion of both the task and outcomes. This in turn can help create a culture of children developing the important skills of sharing, helping and communicating – all those skills that are vital to their development as social beings, as well as mathematicians.

What is one hundred percent certain is that different children will achieve different outcomes either in terms of what they produce (on paper or on sugar paper), or what occurs inside their minds.

Pace

Finally to the issue of pace; however, this piece of writing is already long enough, so I shall sign off by asking some closed, rhetorical questions:

a) Whose pace is important, the teacher's or the children's?
b) Does pace have to infer a fast pace?
c) What kind of pace is appropriate to a class of children?

Now there is a tradition in ATM not to provide answers, but given my questions were both closed and rhetorical, here they are:

Answers: a) Children's, b) no, c) there isn't one.

Mike Ollerton is a free lance consultant.

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