Secondary & Further Education Magazine 98

National Centre for Excellence in the Teaching of Mathematics

Welcome to Issue 98 of the Secondary Magazine (incorporating FE)

Did you know that jellyfish are 98% water?

The first swallows are here, the sun is out, it must be the exam season! This issue includes some articles to impact on your professional development, some practical ideas for the classroom and some suggestions to extend learning beyond your classroom. Hope the revision is going well!

Contents

From the editor: improving the quality of teaching

Under the current Inspection Framework there are four key areas:

- the achievement of pupils
- the quality of teaching and learning
- the effectiveness of leadership and management, and
- standards of behaviour and safety in schools.

The grade awarded for the quality of teaching is significant in determining the overall grade. Really, why wouldn't you want any of these grades to be anything less than outstanding but it is this grade that is determined by the thing that pupils experience day in day out; the bread and butter of our professional life is the quality of teaching in our own classrooms. Designing experiences that maximise pupil learning and managing that learning; that is what we, as teachers, do best.

So if pupils do not experience outstanding lessons in your department, what do you do about it? If your own teaching is not yet outstanding, what steps do you take? I would suggest that most teachers want to be outstanding but are often not sure how to achieve that almost magical status.

Having a focus on the move from *Good* to *Outstanding* within your department helps to reinforce that improving the quality of teaching is a key part of your action plan. It may be that you have a success criterion that says something like:

100% of lessons good or better and 50% of lessons outstanding by Summer 2013

A good intention – but what do you actually do to achieve that? Again, you may be doing a lot of monitoring to see if you are on track to achieve that success criterion, but what are the actions that underpin it?

Ofsted have recently published a set of grade descriptors for mathematics. The challenge is how to design a learning experience that enables teachers to get underneath the words on the page and understand the meaning behind these statements. In an attempt to do this I took the descriptors for the quality of teaching in mathematics and put them onto separate cards. During a department meeting, teachers sorted the cards into Outstanding/Good/Requires Improvement/Inadequate categories. Teachers then chose to either work on the outstanding cards or the good cards (according to need) and try to describe features of their recent lessons that might have met those criteria, or identify the changes that they could make to their practice to fit the statements.

Of course – that doesn't mean everyone is outstanding overnight but it did provide a forum for focussed discussion. Watching other teachers can be really useful in improving practice, particularly watching in pairs so that teachers can talk together about the things they have seen and identify together the outstanding features of the lesson. Watching a lesson with the criteria for outstanding lessons and a highlighter might initially seem a little off-putting but if the focus is on understanding the criteria and identifying examples, in pairs, rather than judging the teacher – that may be more acceptable?

You may wish to consider some of the Excellence in Mathematics Leadership materials to form the basis for a future conversation, or consider an article from a previous issue of the Secondary Magazine Are you a XXX teacher? Why not tell us how you are improving the quality of teaching in your classroom?

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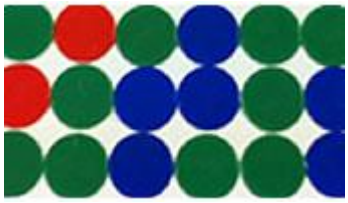

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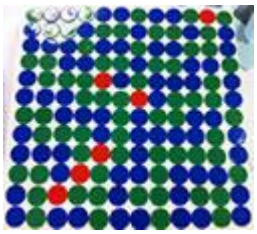
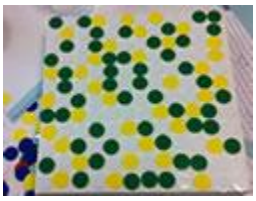
A resource for the classroom – a practical resource to develop understanding of proportional reasoning

There's no doubt that proportional reasoning is one of the key ideas that underpins the secondary curriculum. Is there? I'm always keen to find some ways of improving pupils' intuitive understanding of proportional reasoning so was eager to try out an idea from a colleague. Some teachers of mathematics love practical lessons; if you are not naturally a practical person, please keep reading – this is not as messy as it might look at first glance.





You will need:

- an artist's canvas per pupil or per group. The ones in the pictures here are 20cm x 20cm and cost about £1 from a budget outlet.
- a packet of counters (I used packets of 1 000 which come in five colours)
- some tubes of glue.

I found that 144 counters (12 x 12) fitted onto a 20cm x 20cm canvas. That's a nice number to use for ratio and proportion!

Step 1: Pupils have to decide which ratio they want to illustrate on their canvas and then work out the number of counters of each colour that they need. To make this more of a problem solving activity, pupils can be allocated a packet of 1 000 counters between a group of six. They then need to work out which ratios they could all show using the counters allocated. I found a spreadsheet was a good tool to help with planning - firstly, pupils can work out some possible ratios and then pick the combinations that allow them to allocate the counters for the group.

ratio	red	yellow	green	blue	white	total
1:1	72	72				144
1:1:1	48	48	48			144
1:1:1:1	36	36	36	36		144
2:1	96	48				144
3:1	108	36				144
5:1	120	24				144
1:2:3	24	48	72			144
						0
						0
						0

Step 2: Having decided how many counters of what colour they are going to use, pupils need to decide how they are going to place their chosen counters on the canvas. Some pupils chose a totally random pattern by deciding they would put the correct number of counters in a bag and draw them out in turn to stick on; some pupils decided on colour blocks that make the ratios obvious; some pupils decided to make a pattern; one pupil chose to illustrate a 1:2:3 ratio, decided that each row and column would also be in

the ratio 1:2:3 and was surprised that this was easy to achieve (another mathematics problem here I think!). Pupils drew out a 12 x 12 square on squared paper and planned their designs before they started with the counters for real

Step 3: This is the potentially messy bit but doesn't need to be! First tip – you are the only person who touches the glue. You need the strong, solvent-free, transparent sort that comes in tubes. The canvas doesn't need to be covered in glue – you can apply a thin line of glue to which pupils then stick their counters – twelve times per canvas. Pupils end up with quite a professional looking piece of art

Step 4: Pictures at an exhibition. Pupils need to provide the sort of card that goes with a piece of art at an exhibition. This will need some drafting. I showed them an example to help them understand what was needed:

> ***This canvas uses 144 red and blue counters in the ratio of 2:1. The counters have been randomly stuck on the canvas***

Step 5: I have now done lots of different Step 5s.

- view the canvases without their cards and invite pupils to guess which ratio is depicted on each canvas
- make some arrangements of the canvases. This could be according to the density of a particular colour, ones that show the same ratios, etc
- invite pupils to work out (not count) the number of counters on each using the ratio
- invite pupils to work out the number of counters needed of each colour if the area of each canvas was doubled, trebled etc in size...

I am sure you can think of some much better Step 5s yourself! You now have some high quality display items for your classroom or beyond – pupils are VERY proud of their work.

You may like to read this article which includes a similar idea for understanding ratio and proportion.

Thanks to Chris Haynes from Cullompton Community College for inspiring this resource

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Focus on…The British Museum

Do your pupils experience mathematics away from the mathematics classroom? Issue 90 of the Secondary Magazine invited you to create a Maths trail as one of the legacy projects for the Institute of Mathematics and its Applications (IMA). Some museums and churches have also begun to exploit the mathematics within their institutions - you can find some of these in the Learning Maths Outside the Classroom microsite.

In this article we Focus on *the mathematics within The British Museum.*

How do you provide an enriching mathematics experience outside the classroom? Here's one solution - the KS3 Maths Challenge at the British Museum!

"I learnt different things than I normally do in a Maths lesson"; a student from West London Free School.

The Nereid tomb

The amount of visual stimulus for mathematics at the British Museum is vast, from the geometry of the Great Court to Egyptian taxation records. Dig a little deeper and the mathematics involved with the objects create a wealth of investigations. The KS3 Maths Challenge is a teacher-led session in which groups of students rotate around different activities in the museum, including the recently opened Citi Money Gallery. The challenges are designed to focus on developing students' mathematical thinking by using key processes and applying a variety of mathematical concepts to unfamiliar scenarios.

The Nereid tomb

Using a simple clinometer, provided by the British Museum, and invented units of measurement, students determine strategies to measure the height of a huge tomb from southwest Turkey in Room 17: Greece and Lykia.

Chinese Ming banknote

In Room 68: The Citi Money Gallery, students have the opportunity to analyse the Chinese Ming banknote from AD1375 and mathematically compare it to a modern day British banknote.

The Maths Challenge is available every day at the British Museum and can accommodate up to 70 students. There is no charge for using this resource and packs of materials are supplied by the museum to support the visit. Bookings should be made in advance; further information can be found on the Maths Challenge webpage or by visiting the Learning section of The British Museum website.

Chinese Ming banknote

5 things to do

Find out about the new Government programme to improve mathematics teaching at Key Stage 3.

Check out the fantastic probability resources on the NRICH website Great Expectations: Probability Through Problems. There are eight articles to stimulate thinking about the way probability is taught in schools; some probability resources for teaching the curriculum including The Dog Ate My Homework; and the five sections of Exploring the Mathematisation of Probability, which includes activities considering how to guess the number of sweets in a jar, whether to insure a mobile phone, and how scientists predict the population of wild animals.

Consider putting in an application for the NCETM Collaborative Teacher Projects programme – applications need to be received by **noon on 21 June 2013**. This funding could enable you to work with a group of teachers in a group of schools; a focus on mathematical proficiency would be preferred.

Encourage your pupils to visit the amazing BBC GCSE Bitesize website as one of their revision tools.

Consider attending the Family Fun Day at the Royal Institution in London on 8 June. It promises to give opportunities to recreate some amazing inventions. The activities are suitable for 6 – 12 year olds.

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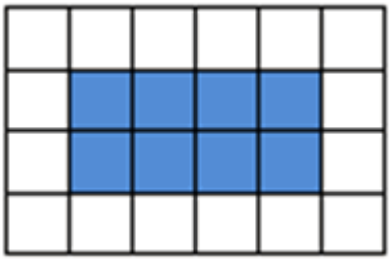
Tales from the classroom: misconceptions with perimeter

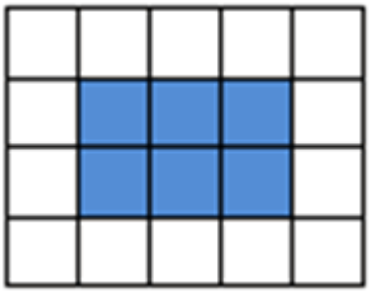
I was using the activity about area and perimeter in Issue 31 the other day with a Year 7 class. I know that pupils find area and perimeter difficult; having taught for quite a few years, I know that this will be an area where pupils have many misconceptions so I wanted to try to tackle them early. I used to think that pupils just got the labels wrong, confusing area with perimeter etc and thought the activity would help to work on the ideas.

In the starter activity one pupil in particular was just not giving me the answers I was expecting when I asked for the area and perimeter of the blue rectangle:



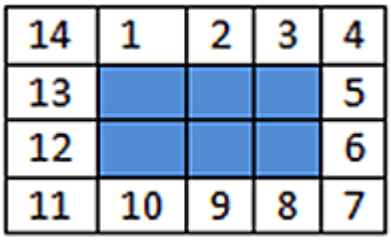
I was hoping to see the numbers 8 and 12 on the pupil white boards. If they were the wrong way round, I could sort that out in the lesson. This pupil was telling me 8 and 16.

I tried another one expecting 6 and 10. The same pupil wrote 6 and 14.



I decided to carry on with the lesson but made that pupil my first priority when the rest of the class started to work.

Me: Tell me how you got 6 and 14?
Pupil: Well to get 6 you count the blue squares – that's the area
Me: So how do you work out the perimeter?
Pupil: I count the squares around the outside like this:



The best thing about this exchange is that I had learnt something about pupil understanding: this pupil was doing something very logical – just not the thing needed to work out the perimeter.

The worst thing about this exchange is that I had probably caused the misconception by saying something like 'count the squares around the edge'. In my head that sounds like a reasonable explanation but I now realise it can be interpreted in a different way.

This incident has made me think about my language in the classroom; there must be other times when I give well-intentioned explanations that totally mislead. The next time a pupil doesn't understand something, I know I need to really listen to that pupil's explanation – and listen to my own responses equally attentively!