Secondary & Further Education Magazine 91

National Centre for Excellence in the Teaching of Mathematics

Welcome to Issue 91 of the Secondary Magazine (incorporating FE)

Having had a good break over the summer holidays, often despite the weather, the start of the new school term can be equally refreshing and invigorating: new classes, new staff, new ideas. This issue of our Secondary and FE Magazine can support your crisp start with some items for reflection, some interesting resources, and some things for your 'to do' list. Have a good term.

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From the editor – Examination results

Another summer – another set of external examination results. How did your pupils fare this year? It is nerve-wracking for pupils and teachers to come into school in August and find out if those hours of hard work have paid off. Have the pupils been able to get the credit they deserve for those hours of study? Have the revision strategies been appropriate? Was there any more that pupils and teachers could have done?

Now that GCSE examinations are marked online, the examination boards are able to offer a full breakdown of the papers - perhaps you have already accessed the results for your school? Once I have looked at 'borderline' pupils, I will step back a pace and try to get a feel of the strengths and weaknesses of mathematics in my school. Are there some topic areas that stand out as problems for our students? Are these the things that I would have expected? What will we do about this in the coming year?

Are there different sorts of questions that pupils in my school find hard to access? Are they able to tackle the problem solving questions? Do we need to give them some extra opportunities and skills to enable them to tackle these questions effectively?

I was quite surprised to read paragraph 218 from the recent Ofsted report Mathematics: made to measure:

> *'In a few exceptional cases, systematic analyses and evaluation of impact have led to improved provision; through increased focus of support and intervention, and changes to the way concepts that pupils found difficult have subsequently been introduced'.*

As teachers, we want to give our pupils the very best opportunities but this report talks about a few exceptional cases where improved provision is achieved. I'm trying to think of an example of this in my school: a few years ago, after analysing SATs papers, we discovered that pupils did not have an understanding of percentages that went right back to Year 7. So, having worked on this and experimented with different ideas, we all decided to teach percentages as a subset of our teaching on fractions and always referred to a percentage as a fraction with a denominator of 100. I now need to extend this idea of changing the teaching approach to some of the topics that I am identifying from my GCSE analyses.

A relatively new target in mathematics at Key Stage 4 is the percentage of pupils who make at least three levels of progress from Key Stage 2. To help me look at this I have recreated the progress tables (which you can find on page 68 of your school's RAISEonline summary report). This enables me to look at the progress of all pupils and to determine how to help pupils across the ability range in accordance with the Prime practice example in paragraph 220:

> ***Prime practice: intervention for all who need it***
> *Intervention and revision contributed significantly to pupils' success in examinations. Pupils were divided into key groups: low to middle ability girls who had underachieved previously; underachieving boys; poor attenders; those on track to meet the five A* - C threshold; and a group who were making secure progress whatever their starting points.*

All groups received support and encouragement relevant to their needs. In this school, intervention was about the achievement of individuals rather than simply those on the C/D borderline.

What will you do as a result of your examination analyses?

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A resource for the classroom – Census 2011

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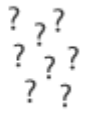
This is the estimated population of England and Wales in the recent release from the Office for National Statistics of the data from the 2011 Census. Beware - you could spend a considerable amount of time looking at this data, in particular the two easily accessible sections: 100 years of census and the highly addictive 2011 Census comparator.

100 years of census shows a population graph split into male and females. The scroll bar at the bottom of the graph allows the user to change the year being considered (from 1911 to 2011) and watch the effect on the population graph. Additionally, the accompanying text highlights significant events that cause the changes to the shape of the graph, and puts the year into context with contemporary world events. Running the mouse over the graph will display extra data about particular age groups in the year considered. This may sound complicated – it's not! Do have a look.

The *2011 Census comparator* is another intuitive interactive tool that allows the user to compare population estimates for any two regions side by side (or overlay them), overlay the 2001 figures and see the data as a percentage or as a number. For example, it is possible to display the 2011 population data for England and Wales on one graph and next to it, the same data for a particular city: I chose Exeter and was struck by the bulge in the 20 - 24 age group. Comparing regions is also possible: the South West and the North East look fairly similar (and a swift overlay confirms this feeling) but comparing say the South West with London shows some startling differences.

So how will I use this? For pupils in our school, writing comments about the interpretation of graphs is something they find difficult. I hope they will find these census graphs intrinsically interesting so I will display some of these graphs, probably as starters, this term. If I have two graphs side by side I may ask pupils, working in pairs, to find some things that are the same about the two graphs and some things that are different. There similarities and differences can be shared within the class before each pair of pupils then writes a sentence in their book to practise their literacy skills.

Why not tell us how you have used the census data?



Focus on…questioning in mathematics

Asking good questions that promote higher order thinking is a critical factor in enabling pupils to develop conceptual understanding and make rapid progress with their learning. Having a departmental or a personal focus on questioning over time would highlight this important aspect of our practice and make a difference to the learning experiences of pupils. Here are some possible sources of stimulus material to enable you and your department to further consider questioning in mathematics lessons.

The NCETM departmental workshop Questioning is intended to allow you to explore the learning experiences of pupils with particular reference to the questions that are asked in mathematics lessons. Different sorts of questions have different purposes and demand different forms of response and engagement from pupils. The overarching question for this workshop could be, 'How can I improve my questioning skills to enhance pupil learning?'

This resource is not written specifically for mathematics but does provide some good things to think about. Pedagogy and Practice: Teaching and Learning in Secondary Schools, Unit 7: Questioning.

The NCETM hosts a module for specialists in post-16 education and training, which tackles questioning.

Improving Learning in Mathematics has a series of professional development resources which includes a module, Developing questioning.

You may like to consider one of the NCETM Research Study Modules. Module 4 is based around John Mason's article, Effective questioning and responding in the mathematics classroom (2010). John asks how question arise and then conjectures on the nature of questions as a tool to focus or direct another's attention. He discusses specific types of question such as control and closed, enquiry and meta questions. John suggests that a pattern of work where learners ask each other for help before asking the teacher is essential in a questioning conjecturing classroom.

5 things to do

As it is the start of the new school year, you may want to consider subscribing to one of the professional associations for mathematics teachers: some offer a journal which can be a useful source of ideas to work on.

View the ptolemy.co.uk flash application Primitives, which you could use as part of a sequence of lessons on the properties of numbers.

The Association of Teachers of Mathematics (ATM) has published details of its 2013 Easter conference, Maths for Real, which will take place in Sheffield. There will be a wide range of sessions available, evening activities and, of course the ATM Workshop - all set within the hotel, which is a Grade-II listed building.

Have you thought about contributing to a thread in the NCETM communities? There is an unusual clock in the Maths Café, or some sharing of mathematical apps, or what does DAD mean to you?

If you were ever in any doubt that there is a connection between music and mathematics, then do spend a few minutes looking at this explanation of how Bach's 'crab' canon works.

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Tales from the classroom

This is an unusual *Tales from the classroom*, as I haven't been in my classroom this month! I have, though, been thinking about setting the tone for my new classes. How do I start with new groups who might not know me at all? How do I start the year and show my students what I value?

What is it that I value anyway? My knee-jerk answer to that question is that I want students who can solve problems. But what does that mean?

I want them to want to know 'why?' To feel just uncomfortable enough to be curious. To know that there's something going on and that it's just within their reach. I want them teetering on the edge of their thinking.

The best way I can find to exemplify this feeling is from a trip I took a while ago to go and see a stand-up mathematician. Matt Parker came to my town and started the show by throwing out calculators to the audience (one person had actually brought their own along - It was *that* sort of audience!). He asked us to pick any two-digit number and then to cube it. We shouted out the cube, he told us our starting number.

The friend that I'd gone with was convinced that he'd 'simply' memorised all of the possibilities but I was curious about the trick and spent a while trying to work out strategies (if you're interested in the mechanics of the trick there's a good description on mindmagician.org).

It's this belief that there's a structure to discover and the confidence, patience and skills to go looking for it that I want in my students so I've decided to share this story with them, to do the trick but to not explain how it works. I hope to return to it through the year, particularly when we're looking at number properties, but also whenever things get tough. I think it's helpful for them to know that I'm also curious and that I get stuck and try the wrong things when I'm working on a problem.

I want them to understand that I'm not always going to tell them how to do something, that I value them getting stuck and persevering. That I *intend* that they get stuck. So my first lesson with most classes is going to run something like:

- tell the story and do the trick
- give out an activity which is, I think, accessible for most but is initially quite daunting. For this I'm going to use The Great Race from the Maths4Life Folder (it's on the last couple of pages of this document)
- ask students to reflect on what maths they did and to write some tips for other classes when solving the problem.

My hope is that, in solving the problem, my classes will feel what it is to be a mathematician. They'll spend some of the lesson being confused, some of it being curious and, if I get the trick right, some of it being astonished. They'll get the satisfaction of solving a problem which is challenging enough and they'll get to reflect on strategies that were most and least successful.

If I can maintain that momentum for the rest of the year then were all going to enjoy our lessons a whole lot!