Secondary Magazine Issue 87

National Centre for Excellence in the Teaching of Mathematics

Welcome to Issue 87 of the Secondary Magazine.

Contents

From the editor – The NCETM 'essentials' collection

I was pleased to see the launch of the NCETM 'essentials' collection recently. I particularly like the opening paragraph in the news item that introduces it:

> *Supermarkets have huge amounts of stock and finding what you want, when you want it, is sometimes a difficult job. They use 'essentials' or 'meal deal' collections to bring things together in one place, so that customers don't have to spend more time looking*.

Being a frequent user of the 'Dine in for £10' option at a certain supermarket, I thought this would be just what I needed, so it was with interest that I went to the Guidance page to see what was available.

In place of my usual main course, side dish, pudding and wine, is a group of icons representing an *Overview*, *Learning from each other*, *Resources*, *Courses and Networks*, *Discussion Point*, *Personal Learning* and *Explore a piece of mathematics*. These headings apply to a range of areas which include:

- Calculations
- Digital technologies
- EYFS maths in everyday situations
- Primary NQTs
- Primary schools working with other schools
- Rich mathematical tasks – Primary
- Secondary NQTs
- Secondary schools working with other schools
- Supporting staff in primary schools
- Working with teachers and leaders in other schools
- Teaching low attainers
- C/D Borderline Intervention
- Functional Mathematics.

As a large part of my attention is currently being given to the new GCSE specification and functional mathematics, this was my first port of call. Clicking on the *Resources* tab, I was delighted to find a whole range of things all in the same place - just as it said on the packet! Having spent a happy few minutes looking through some Departmental Workshops, the Maths in Work videos, the NCETM microsite ICT and Digital Technology used in mathematics teaching and much more, I know that I will visit again.

I expect that the NCETM 'essentials' collection will transform my 'dining in' experience for some time to come.

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It's in the News!
Phone contracts

Have you got your new iPhone 4S yet?

People queued overnight to make sure that they were among the first to own the latest offering from Apple, but which contract is best? This resource uses the launch of the iPhone 4S as a context to allow students to explore what a graph could mean and then to reason mathematically about which contract is most suitable for three different users.

It's in the News! is a resource that explores a range of mathematical themes in a topical context. The resource is not intended to be a set of instructions but a framework which you can personalise to fit your classroom and your learners.

Download this *It's in the News!* resource - in PowerPoint format

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The Interview – Els De Geest

About you
I am Belgian, married to a Dutch guy, and have a son who is at university. We came to the UK in 1989, with the intention of staying a year, and are still here. What we both like very much about living in the UK is that we feel we can be who we want to be.

I am currently a lecturer at the Open University, an institution I admire greatly because it truly offers the opportunity for lifelong learning without needing to rely on how well you did at school when you were an adolescent. I did all my (successful) university studies with the OU: BA (open), BSc (Hons) in mathematics, PGCE mathematics and a PhD in mathematics education with John Mason as supervisor. Previously, I worked as a researcher in mathematics education at the University of Oxford with Anne Watson, as director of the RECME project for the NCETM, as a mathematics consultant in Slough and as a teacher of mathematics in both state and independent secondary schools.

My passion is to put research into classroom practice, and vice versa – I am rather pragmatic. My research centres around what happens in the process of making sense, and its application in the teaching and learning of mathematics – in the mathematical thinking and professional development of teachers of mathematics – for example, when working mathematically with low-attaining students. It has resulted in some publications that I co-authored and authored: Deep Progress in Mathematics, Building Learning in Mathematics and Many Right Answers.

The most recent use of mathematics in your job was...
an hour ago, writing assignment questions for one of our undergraduate mathematics courses.

Why mathematics?
That is an interesting question. I did the equivalent of A-level mathematics in Belgium, passed but did not really have a clue what I was doing. I went on to study economics at university in Ghent and failed the first year twice…for the mathematics part of it! At the time when I started studying at the OU, you had to do a foundation course. My preferred choice was arts or social sciences. However, mathematics was the only one without a waiting list so I chose that. The course made me fall in love with mathematics! I finally gained some understanding of what mathematics was about and I found it most intriguing. After obtaining an open BA which also included economics, environment, computing and psychology, I went back to the discipline I had enjoyed studying most and did a degree in mathematics. Mathematising gives me a strong aesthetic experience. I love the complexity, the knowledge that I will never know it all and the elegance of the argumentation, although I must admit my mathematical reasoning is often very messy!

Some mathematics that amazed you is...
I am constantly amazed by mathematics. Most recently I was taken again by the beauty and elegance in the use of matrices and networks. I get great pleasure in discovering or developing a mental image for some mathematical concept. For example, what has kept me thinking in amazement for years, is a very simple mental image of what the operation $\sqrt{}$ means. Mental images allow me to see mathematics in my head, to make connections and to move things around. It keeps me entertained for hours on end.

Two significant mathematics-related incidents in your life were…
One: falling in love with mathematics when doing the OU foundation course (see above).
Two: the realisation of how potentially damaging is working on models of deficiency - giving labels to people. The latter happened when I was observing two classrooms on the same day. In one classroom, the teacher and the students in a top set were constructing some truly beautiful mathematics rich in

mathematical thinking. In the other classroom, low-attaining students were working on writing mathematics neatly and practising timetables, because it was in doing those things that they were considered 'deficient'. It made it blatantly clear to me that attaching labels to students often puts a ceiling on their opportunities for learning mathematics. I think that is very unfair.

The best book you have ever read is…
I 'binge-read' novels during holidays, and read rather little at other times, because I find it hard to stop reading once I have started. I was much taken by *The Book Thief* by Markus Zusak. What surprised me is how there was so much suspense, while you know from the very start of the book that the story will end with the death of the main character, as the narrator is Death. It is what happens in the process of living that is important, not so much the result. Which is similar to my views on doing mathematics.

Who inspired you?
I find this a hard question to answer. I find Gattegno's writing very inspirational. People-wise: people I work and think with. Some are more prominent in my thinking, such as John Mason, Anne Watson, the Gattegno reading group. But I get equally inspired from talking to teachers, students, academics or friends.

If you weren't doing this job you would...
probably do another job in education: I am from a dynasty of teachers and head teachers - at least five generations. My brother, sister and I were adamant as teenagers that we would not go into education. Of course, it turns out we all did. Somehow we do not seem able to escape, but I feel very happy with that destiny!

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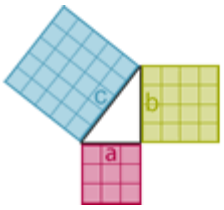

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A resource for the classroom – Pythagoras

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I must admit to being quite impressed with this YouTube clip when a colleague pointed it out to me a couple of weeks ago – such a simple idea, but demonstrating a mathematical certainty. It has taken me a bit longer to work out exactly what it is I like about it and how I am going to use it in the classroom.

So how do you start to work with the ideas in Pythagoras' theorem? Being able to find the length of a side on a right-angled triangle using Pythagoras is one of the essential 'C' grade criteria at GCSE which continues to flummox many pupils - and has a practical application that some pupils will use. I know I don't want to start by telling pupils that you 'square them, add them together and find the square root'.

Having tried out lots of different ways of tackling this in the classroom, my current favourite is to use the ideas in the NRICH problem Tilted Squares. All pupils can find the areas of squares: it is a good thinking and reasoning exercise to work out how to find the areas of squares that are 'tilted'. Having got lots of examples, I then want pupils to work systematically and find some results which might suggest that there is some relationship between the area of the square and the 'tilt'.

At some point, I feel that I need to give pupils lots of different 'experiences' of the relationships between the squares (and ultimately the right-angled triangle). Here is where some of those dissections and some of the interactive ideas under Proof 1 - Proof 5 can be useful.

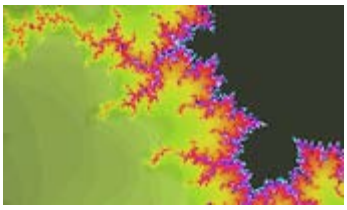
Another helpful set of resources can be found on NRICH. Here, the progression from demonstration to proof is nicely provided in Pythagoras Proofs, which includes Pythagoras Puzzler, Garfield's Proof, and Matter of Scale.

Back to the YouTube clip which stimulated me this week. It's not proving anything - but provides a good demonstration. Our interviewee this month, Els De Geest, talks about the power of mental images; this entertaining clip will provide a powerful mental image for pupils which might enable them to recall some of their understanding of this idea before they 'square them, add them together and find the square root'.

You could also look at:

- Secondary Magazine - Focus on Pythagoras
- Primary Magazine - A little bit of history

- Pythagoras problem solving
- Contribute to the thread in Maths Café.



5 things to do

You could encourage your pupils to enter a competition to win a £100 Amazon voucher that asks them to design a poster about a famous mathematician. The competition for older pupils is to write an article on the legacy of the work of Alan Turing.

Celebrate Benoit Mandelbrot's birthday on 20 November 2011 by creating some displays of fractals or using the Sierpiński triangle investigation.

Why not use the new NRICH activity Statistical Shorts?

Use some more ICT in your lessons. These lesson reports and case studies might inspire you.

Follow the countdown to Christmas and start your shopping!

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Tales from the classroom

I've been thinking about quality versus quantity recently.

A couple of days ago one of my colleagues came into the maths office looking for new exercise books. One of her students had already completed a book that they'd started in September. As I write this that's about six and a half weeks ago!

Now, this colleague is an experienced teacher but most of her lessons follow a very familiar, traditional pattern of a bit of talk from her followed by a lot of work from the class using a text book or worksheet which means that there's a lot of writing involved in her classes. She doesn't really hold with (to paraphrase her) my 'trendy' ways and she gets good results from her GCSE classes.

I flicked through the books that I was marking and none of my group had even reached the staples yet! I found myself having a bit of a crisis of confidence just as I set off to teach my Year 11 group who are all on the knife-edge between a grade C and D.

I had a couple of lessons planned on linear equations after an analysis of module results showed that none of my group had picked up full marks (and many had picked up no marks!) on a question with the unknown on both sides of the equals sign. I didn't teach the group last year and knew that none of them had any experience of clouding the picture and, as this is my 'go to' strategy for developing understanding of equations, I went to it!

Over the next couple of lessons, my class built up their own equations and adjusted them from those that they could solve to those that they couldn't. There were mini whiteboards and sheets of sugar paper all over the place, and the class ended up solving just four equations in their books. Talking with them, I could tell that they had a sound understanding of the concepts and, at the end of the second lesson, they all solved the equation that they'd struggled with in the exam.

Reflecting on the two lessons while planning the last lesson of the week, I thought of fluency. While I'm absolutely certain that understanding is key to success, I'm also certain that I don't want my classes working things out from first principles all the time. I think it's important that, for example, they know that 7x8 is 8+8+8+8+8+8+8and 7+7+7+7+7+7+7+7 and can draw a picture to show me this, I also think it's important that they can say 56 to me almost instantly when I ask the question! Understanding and fluency are what I'm aiming for.

So we spend the final lesson of the unit developing fluency in solving linear equations. The class worked on an exercise from a text book, choosing the questions that they thought were at a level that would be just challenging enough.

I found that they worked well and chose questions sensibly, giving me a chance to work with those few that were still not quite there. At the end of the lesson I found that there were several members of the class that I'd barely said a word to and that very few of the class had been stuck. Normally, I'd have felt that this was a failure on my behalf to challenge them but, after that lesson, with its aim of developing fluency, maybe that's OK. I'd be interested to know what others think?