Secondary Magazine Issue 85

Welcome to Issue 85 of the Secondary Magazine.
Back to school! It already feels as if that holiday never happened, doesn't it? This month's issue has plenty of good ideas to keep you in touch with mathematics for the new school year.

Contents

From the editor - Teachers reading research

British Society for Research into Learning Mathematics (BSRLM)

"I'd like to read some research but I don't know where to start." (Mathematics teacher)

In an article in the previous issue of the Secondary Magazine, there were some suggestions for this mathematics teacher which used the General Teaching Council (GTC) web page Research for teachers. In this issue we will look at the web resources of the British Society for Research into Learning Mathematics (BSRLM), and highlight some papers that may be of interest.

BSRLM meets three times a year. The 'informal proceedings' of the meetings are published online and can be freely downloaded (whereas the bi-annual refereed journal 'Research in Maths Education' requires a subscription). Do go to the site and look for yourself, but why not start here?

Do you agree with the statement, 'multiplicative reasoning is the foundation of most mathematical applications and is relevant to all pupils'? This statement occurs in the introduction to the paper, The struggle to achieve multiplicative reasoning 11-14, by Margaret Brown, Dietmar Küchemann and Jeremy Hodgen (you may want to explore part of the NCETM departmental workshop, Proportional reasoning, before you read any more of this article).

Of particular interest in this paper was the comparison between pupils in 1976 and pupils in 2008 as they answered the same questions that required multiplicative reasoning. There are some fascinating interviews with pupils as they tackle a question about enlargement.

As I read these accounts, it was no surprise that the pupils wanted to use an additive strategy to answer the questions, even rejecting a 'doubling' strategy when the numbers were changed in the questions to make this possible. For me, this re-enforced the idea that pupils in my classroom need lots of opportunities to make comparisons between numbers using a multiplicative idea. How does this relate to the pupils in your classroom?

The second paper that drew my interest was A study of the effectiveness of a Dynamic Geometry Program to support the learning of geometrical concepts of 2D shapes by Sue Forsythe, which describes a study being undertaken for a PhD. The author believes that Dynamic Geometry software has the potential to help students to understand the properties of geometrical figures; the figures can be dragged around on the screen and still possess the properties that define them, whilst distractions, such as the orientation of the shape, do not remain constant.

The author has designed a task for pupils to complete on the computer (two pupils working together on one machine) using the 'drag' and 'measure' facilities of the program, which aims to enhance their understanding of the properties of quadrilaterals.

Reading this article has made me think about several things:

- the purpose of my use of dynamic geometry software in the classroom
- that each student working on their own computer does not, in this situation, allow them the necessary opportunities for exploratory talk
- do I fully appreciate the difficulties that students have in understanding geometrical figures?

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National Centre
for Excellence in the
Teaching of Mathematics

What does this paper make you think about?

What will you do now? You may feel inspired to:

- read the papers that I have talked about
- go to the BSRLM website and browse the publications to find other articles to read
- go to the NCETM Research Gateway, from which you can access more articles that may interest you using the filter on the site.

Why not share your experiences and recommend other research papers that have had an impact on your practice?

National Centre for Excellence in the Teaching of Mathematics

It's in the News!
Bee Wear

Do you know anything about bee-bearding?!

This summer the BBC carried a story about two beekeepers in China competing to see who could attract the greatest weight of bees onto their body. The competition was won by Wang Dalin who attracted 26 kg of bees, although this is nowhere near the world record of America's Mark Biancaniello who attracted 39.5 kg of bees!

This resource uses the bee-wearing contest as a context for students to practise estimation and solving complex problems.

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

The Interview – Colin Wright

About you
I'm Director of Research and Innovation at a company that produces equipment to do the equivalent for ships as air-traffic control does for planes. Basically, we help schedule ships in and out of busy ports, and try to stop them from banging into each other! I also make time to travel around giving talks about why maths is interesting, useful, fun and occasionally exciting. My best known talk is about unexpected maths in juggling.

The most recent use of mathematics in your job was…
I can't actually talk about the work I do, because it's research in industry. I specialise in image analysis and compression, coding theory and the design of the way in which 30 or 40 computers can extend over a distance of 200 miles or more, share information and not get confused.

Some mathematics that amazed you is…
using a stopwatch and a pendulum to calculate the distance to the Moon. Simple ideas, simple equations, simple experiment, amazing result.

Why mathematics?
The elegance of the ideas, the power of its reach. Maths turns up in the most amazing places. Topology, for example, is used in cosmology – the largest scale of things we deal with – and micro-processor design, the smallest scale of things we deal with.

Your favourite/most significant mathematics related anecdote is…
When setting out on a long car journey as a child, my father and I would have a little competition to see who could most accurately predict our arrival time, based on the first 30 minutes or so of travel. He always won, and it was only many years later that it dawned on me that it might have something to do with the fact that he was driving. See, I'm not actually that bright…

A maths joke that makes you laugh is…
I have two. Firstly, what do you get if you cross a mountaineer with a mosquito? You can't cross a scalar and a vector. Secondly, there are 11 kinds of mathematicians, those that can count in binary, and those that can't. They're both a bit obscure…

Something else that makes you laugh is…
pretty much anything written by Terry Pratchett.

Your favourite television programme is…
probably The Big Bang Theory. I don't think I watch anything else.

Your favourite ice-cream flavour is…
Rocky Road.

Who inspired you?
A variety of people: my father, Martin Gardner, Mrs Davidson (one of my maths teachers), Béla Bollobás (my PhD supervisor), and more.

If you weren't doing this job you would…
spend more time writing and talking about maths. There's not much else I'd want to do.

National Centre for Excellence in the Teaching of Mathematics

A resource for the classroom – Wound up string

I thought *Wound up string* was a nice problem: it's from the London Gifted and Talented Geometrical reasoning resources on the Teacher Tools website [scroll down to *Geometrical reasoning* in the *Maths Extension through Depth* section, and select *Wound up string* from the drop-down menu].

Wound up string comprises two diagrams: the first is made from a piece of string being wound around a point to make a large circle. In the second diagram, the string is cut along a 'radius' from the circumference to the centre. If the string is now opened out, what shape would you get and what would be its area?

The mathematics part of the Teacher Tools website has two areas:

- maths extension through breadth
- maths extension through depth.

Maths extension through breadth 'uses key stage 4 maths topics as jumping-off points for exploring fresh and exciting mathematical ideas that students won't have seen before. It aims to give students a new sense of the scope and power of the subject and its applications'.

There are four separate areas to explore, each with a teacher's guide and student worksheets:

- Loopy logic
- So solid
- Get connected
- Prove it.

Maths extension through depth 'aims to give students a deepened appreciation of the key stage 4 curriculum in mathematics and of the power of mathematical rigour'.

There are three sections:

- Geometrical reasoning
- Statistical reasoning
- Algebraic and numerical reasoning.

Each section has a variety of student task sheets (and some 'answer' sheets) for use in the classroom.

I need to be interested in a problem in order to excite and inspire pupils – there are certainly some interesting problems in this selection which I will work on with pupils in the coming weeks. If you use some of these problems - do tell us how you get on.

5 things to do

- As it is the start of a new school year, you may have some new members of staff in the department. Why not use the NCETM professional development activities Why do we teach mathematics? or Learning mathematics in my school as a way of provoking some mathematical discussion within the department?

- Have you looked at the Excellence in Mathematics Leadership materials recently? If you have just taken up a post in a different school or a promotion within your own department, there may be something here to help you reflect on your new practice.

- Are you a member of a mathematics subject association? You can read about the benefits of joining a subject association or get details of the individual associations. It is possible for you to join as a department, which can provide a good focus for your departmental CPD.

- Join the mailing list for NRICH. Registration is free and you receive a monthly email giving details of changes to the site, new problems and professional development opportunities.

- The Tour of Britain cycle race is working its way round the country this week. You could watch the cyclists who include champions such as Britain's Mark Cavendish, as they race past you or you could catch up with the TV coverage.

Tales from the classroom

As I've been starting with my new classes I've been working hard to set my agenda for the way that I want my students to behave. I'm not talking just about what we might think of as classroom behaviour, I'm also talking about mathematical behaviour. How they will learn as well as what they will learn

I started with one class (a year 10 group who should all get a C grade with a few Bs) with a Bowland Assessment activity, Cats and Kittens, which I've used a few times before. I really like the way that it allows students to be creative, to construct their own model and I've found that it really generates discussion because so many of the solutions the students generate are so far apart yet seem very plausible.

As always when introducing this type of activity to a class, there was a bit of mumbling and muttering, some avoidance of starting and a lot of 'I don't know what to do' but, after a good few minutes of closing my ears to this and with some strategic pointing out of things that the more successful groups were doing ("Have you seen the table that Kate's group have drawn? I think it's really helped them get started…") all of the groups were able to reach some kind of an answer.

I know that they found it difficult and that the models that they set up weren't as sophisticated as they might have been, but I'm determined to carry on with these types of activities as an integral part of lessons. I can't expect my students to become what I consider to be a mathematician (a problem solver rather than someone who is good at remembering formulae) if I don't give them a chance to behave that way – and that includes struggling, getting stuck and heading off down blind alleys.

I was reminded of the article Models for Teaching Mathematics by Alan Wigley, and am working on how to support my students in developing the problem solving behaviours I want (and which, ultimately, I believe they need to be successful in their exams). I'm finding 'mysteries' such as the Durham Maths Mysteries and the one we published in the previous issue, to be a really useful way of roughing up the path just enough for my classes to make progress with both the 'what' and the 'how' of learning maths.

I'm now considering balance after one of my new year 10s came to me and said, "Sir, I'm really enjoying these problems and everything and I understand what you're doing but we will still do some *proper maths* from maths books, won't we?"