Welcome to Issue 83 of the Secondary Magazine.

It's the summer term – the sun is out and you may just have that breathing space that a Year 11 class provides on the timetable once the examinations are over. We hope there are some items in this edition to interest you as you pause to catch your breath.

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From the editor – **Accessing Research**

When did you last read any mathematics education research? Responses to this question usually cover a range from 'When I did my training' to 'It informs my everyday teaching' but it would seem that there are many people who say things like, 'I'd like to read some research but I have no idea where to start'.

For these people in particular, there is a new microsite on the NCETM portal, Accessing Research, where there are ten study modules – each written around a research paper – to suggest some starting points.

Each of the study modules consists of:
- the module itself (in PowerPoint form) offering you activities, discussion points, etc. related to the research article
- the full research article
- some brief contextualising notes, including things to do before you start, how long it might take and what others who have used this module think of it.

Reading what other people have written about an area of mathematics education that you are interested in can give you a fresh insight into that topic and also provide a different perspective from which to reflect upon your own practice.

Why not put aside some time during the summer term to have a look at one of these modules – perhaps as a pair or small group – as part of your continuing professional development. If you are familiar with the resources produced by the (then) DfES Standards Unit Improving Learning in Mathematics, you might like to start by working on Module 9 based on Malcolm Swan's article 'A designer speaks: Designing a multiple representation learning experience in secondary algebra'.

Quotes form other people who have worked on this module included:

"We thoroughly enjoyed ourselves."
"It is a good module to use as a team CPD activity."

Do tell us about your experiences working on one of these modules.

National Centre for Excellence in the Teaching of Mathematics

It's in the News!
A curious case

Did you hear about the resourceful criminal caught hiding in a suitcase in the luggage compartment of a coach? During the journey, the thief would unzip his case and steal from the other cases in the cargo hold, ensuring that he was safely back in his case before the journey was completed, when he would be collected by his accomplice.

This resource uses this news story as the context for an investigation into volume, asking students to design a case that a man could fit into but that is not too large to appear suspicious!

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 – Marie Joubert

Our interview in this edition is with Dr Marie Joubert who is a researcher in mathematics education at the University of Bristol.

Could you explain how you became a researcher?
I worked as a secondary school teacher for about 20 years and became increasingly interested in the use of ICT in teaching mathematics. I was encouraged to apply to do a PhD at the University of Bristol and was accepted. My PhD study investigated the use of computers in authentic mathematics classrooms (secondary).

Since completing my PhD, I have worked as a contract researcher on a number of projects, mostly involving mathematics, ICT or professional development (in various combinations). In some cases, someone else has been awarded the contract to do the research, and I have applied for a job on the project. In other cases, colleagues and I have bid for a research contract and have carried out the research ourselves.

What are you working on at the moment?
At the moment, I work on a European project called STELLAR, which broadly aims to unify the different research communities involved in 'Technology Enhanced Learning' and to help shape the mid-term research agenda in this area. We (Bristol University) are one of 16 partners across nine European countries and much of our work is conducted by email, Skype or virtual meetings. This is not really research, but I think it is important work because it could influence where and how research money is spent in the future.

Although I am employed full-time on STELLAR, I also do lots of other things. It is accepted within the academic research world that people will always be looking out for research funding, and my line managers support me in doing this. It is also accepted that researchers will be active in the academic community, and for me this means being active in the mathematics education community. But the most important thing is that academics have to write journal articles, and in the back of my mind I am always thinking about what I should be writing. I have lots of ideas, but I don't get round to it often enough because all sorts of other things get in the way!

What does a typical day/week/month look like for you?
In comparison to teaching, I have a lot of freedom to choose when and where I work. I usually go to my office at the University, which I share with three other researchers. Typically, I get in at about nine, grabbing a coffee on the way, and sit down to check emails. At the moment, working on STELLAR, I get lots of emails for work (typically up to ten will be sitting in my inbox when I get to work, and then I get many more during the day). I usually go home about six, and often do an hour or two of work at home.

Most of my work is done at the computer but there isn't really such a thing as a typical day. It depends on what is at the top of the agenda. For example, last month my main task was to produce two 'deliverables'. One was about the intellectual work of STELLAR, which aimed to draw together what we know about the research priorities of our partners and to draft a plan for how we will produce a research agenda by the end of the project. The other was a report on the Doctoral Academy of STELLAR, which includes doctoral summer and winter schools and a virtual community of practice. The deliverables were documents of about 40 pages and had to be carefully thought out and then well written. They are high-stakes documents because the European Commission will use them (plus other deliverables) in the next few months to evaluate how well we are doing in STELLAR.

This month, one big priority is helping to organise the programme for the doctoral summer school. The doctoral schools usually run for a week, and we like to construct a coherent programme of activities over the week, which involves lots of negotiation with the other parties involved. I usually go to the doctoral schools, which gives me the opportunity to work directly with the doctoral candidates – this is one of the parts of the job I like best.

I do some travelling – I go to conferences (usually only if I get a paper accepted), I attend the STELLAR doctoral schools as a 'senior', I go to meetings with European policy makers, I occasionally go to face-to-face meetings with colleagues in STELLAR. I am also on the executive committee for the British Society for Research in Learning Mathematics and go to meetings for that, and I am on the programme committee for two forthcoming other conferences in mathematics education, so I go to meetings for those.

I also do some teaching of masters students at the University of Bristol. At the moment, I teach on a course called Introduction to Education Inquiry, working mainly with part-time students who are practising teachers. The seminar sessions run from 5:30 to 7:30 in the evening. I enjoy this teaching enormously.

How do you decide what to research next?
I don't. I try to get funding, and hope I am successful. If I had the choice, though, I would like to research something related to professional development for teachers of mathematics, particularly related to the use of ICT.

Do you see things that really inspire you?
Yes, when I go into schools to do research, I am bowled over by some of the fantastic work that is done in schools. For example, I was researching what sort of impact the NCETM teacher enquiry projects seemed to be having, and for this I went to the schools of some of the award holders to interview them. Some of the things they were doing really impressed me and I felt honoured that they shared their work with me.

This is a bit cheeky but do you think that your work has an impact on 'education'?
It's not cheeky at all, and I think it is an important question. I think it often takes a long time for research to filter down into schools, so it is difficult to show direct 'impact'. I would hope that my work with masters and doctoral students has an impact on them and their pupils – but that isn't really what your question is about, is it? In terms of my research, I can't give direct evidence of impact, but I hope somehow that it is useful… for example, perhaps that the work I did about professional development for teachers of mathematics (the Researching Effective CPD in Mathematics Education [RECME] project, funded by the NCETM), might have influenced professional development programmes.

A resource for the classroom – **Missing Multipliers**

I've been spending a lot of time recently, trying to understand what makes a good lesson 'outstanding'. One of the criteria in the Ofsted publication Generic grade descriptors and supplementary subject-specific guidance for inspectors on making judgements during subject survey visits to schools states that: "Resources, including new technology, make a marked contribution to the quality of learning" and that "problem solving, discussion and investigation are seen as integral to learning mathematics."

Using the NRICH task Missing Multipliers, I'm wondering if I can improve my understanding of what makes a lesson outstanding?

The task involves pupils working out the outside numbers of a multiplication grid by revealing the inner numbers. It can start off as a way of practising multiplication facts, but the real essence of the task is to determine the minimum number of inner squares that need to be revealed in order to determine the outside numbers. Easy?

I decided that my pupils would benefit from filling in a multiplication grid first, so I gave them the opportunity to fill in the grids on the resource sheet at the very start of the lesson. I included an example where there was more than one possible answer, as I find this unsettles the pupils I teach and gives them an opportunity to justify the answer that they have given.

The next step was to display the task from the website and to give the pupils a mini whiteboard and pen each. I invited a pupil to reveal ten squares and we worked as a class in trying to determine the outside numbers. We couldn't actually complete this example as the position of the revealed squares did not give us that possibility. Then it was over to the pupils. They had a laptop between two and worked to try and find a strategy to reveal the least number of squares.

So how did it go? Every pair of pupils was engaged throughout the lesson. Every pair of pupils could contribute to the plenary session where different pupils talked through their strategies for six reveals. Some pupils moved on to use a larger grid and generalise their strategy.

Was it an 'outstanding' lesson? I'm not sure! I do know that the use of new technology enabled the pupils to engage with the structure of a problem and in doing so had plenty of opportunities to reason and justify their mathematical thinking. Why not try this task with one of your classes and see if your pupils respond in a similar way?

5 things to do

- There is still time to apply to join the TSM residential training at Oundle School near Peterborough, which runs from 11-14 July. This residential focuses on ICT within mathematics and is usually a sell out.

- The National STEM Centre in York is hosting a one-day conference on 4 July, Leaders of Learning in Mathematics. Speakers will include Jane Jones HMI and Rob Eastaway, author and broadcaster. There are a range of workshops which include formative assessment, developing mathematical independence, building problem solving skills from KS2 into KS3, supporting students working at lower levels, teaching 'A' level in practical ways, using new technologies and social media to engage students.

- Rich Mathematics – Sheffield Hallam University is offering a course for mathematics teachers focusing on classroom work with rich tasks, which leads to a post-graduate certificate and can form part of an MA in Learning and Teaching or an MA in Mathematics Education (subject to validation). This two-year course starts this month.

- Investigate the mathematics in the design of the new Olympic torch: could you make one?

- Alex Bellos (author of *Alex's Adventures in Numberland* and *Here's Looking at Euclid*) is carrying out a short international survey, as part of a project he is researching concerning how humans relate to numbers. He is interested to know your favourite number and the reasons for your choice.

Tales from the classroom

We've been looking at percentage changes this week with my Year 7 middle group. We're two lessons in so I wanted to find out what they've understood so far.

I started the lesson with the question, which is better: 25% off or 25% extra free or are they the same thing?, and I gave them a few minutes with one whiteboard for each pair to decide.

While I was walking around, I could initially hear a lot of conversation about how to show that they were the same thing (this seemed to be the general consensus), and students started to pose questions and generate situations themselves to illustrate their initial gut instinct. After a few minutes though, the feel of the classroom changed as some of the pairs found that the numbers didn't back up their initial thoughts. There was a certain amount of discomfort and checking of answers as they found (as one pair did) that if the initial situation was buying four chocolate bars for £1 then 25% extra free gave a price of 20p per bar while 25% off gave a price of 18.75p per bar. This couldn't be right!

As they started to work through their 'stuckness' and understand the situation a little better, I talked with a couple of pairs and asked them to practice explaining their thoughts so that they could share them with the whole class. There was one girl in particular that I was keen to get to explain:

"Imagine if, right," she started, "eggs came in fours, not sixes," she said to the class and drew four eggs on the board
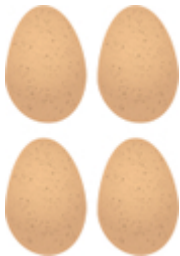
"Right, like, if there's 25% extra free then you pay for four eggs and get one free," and she drew the diagram

"But if you get 25% off then you pay for three eggs but get four"

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"So they're the same because," and here she raised her voice triumphantly, **"both ways you get a free egg!"**

The conversation that she generated with her (I have to admit!) very convincing argument, and the number of students helping her to untangle her misconception, was a joy and we ended the lesson with each student composing a 'text message' (to keep it short!) in their book trying to help someone with the same misconception.