Secondary Magazine Issue 86

Welcome to Issue 86 of the Secondary Magazine.
As the autumn term is well under way and the summer holidays are just pleasant, distant memories, this edition of the Secondary Magazine includes some articles to focus on work in the classroom.

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This September, Channel 4 and E4 finally stopped repeats of *Friends* after showing the comedy since its first broadcast in 1994. This resource uses the worldwide pervasiveness of the show as a context to explore estimation and problem solving, with a focus on identifying any assumptions that are necessary.

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Dave is Professor of Mathematics Education at the Institute of Education, University of London. In this interview he talks about his work, past and present, and concludes that he would have been better off financially as an actuary.

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Tales from the classroom

What sort of lessons do you do when you are being observed? Do you take some risks in the classroom and show the high quality learning that can happen as a result? In this issue's *Tale* there is a description of a lesson that did just that.

A Department for Education initiative to enhance professional development across mathematics teaching

From the editor – A world-class mathematics education for all our young people

When I got back from my usual fortnight in France this August, I was grateful for an NCETM Facebook post, which told me that the report A world-class mathematics education for all our young people had been published while I was away.

In case you have lost track of which report this is, the URL contains the characters *'Vorderman maths report'*. It would be more accurate to say that Carol Vorderman (she of *Countdown* fame), chaired a task force made up of Roger Porkess (lead author), Chris Budd, Richard Dunne and Pepe Rahmann-Hart. The scope of the report aims to assess:

- where mathematics education currently stands in England
- where it needs to be in order for us to compete internationally on an economic basis, and
- what is needed on an individual basis for students to be mathematically literate, and so able to fulfil their potential in future life.

The report goes on to discuss three major issues:

- the importance of primary school teachers
- the scale of current failure
- giving up mathematics at age 16.

As with any report, I skimmed through it quickly but then found myself being drawn in to reading much of it in greater detail, nodding in agreement with some parts and disagreeing with other paragraphs – it's human nature, isn't it? At the end of it, I found I was formulating a professional response to the report. I know my vision for good quality mathematics teaching in the classroom and from this standpoint I was able to interact with the content and recommendations in the report.

There are many things that I need to think about further as they have challenged my current views and I am looking forward to discussing them with my colleagues in the coming term as a way of consolidating our departmental views about teaching mathematics; this report has provided a useful stimulus for our professional debate this term. How will you use the report in your department?

It's in the News!
Friends

This September, Channel 4 and E4 finally stopped repeats of *Friends* after showing the comedy since its first broadcast in 1994. The 236 episodes seem to have been on an almost permanent rotation for the last ten years – I wonder how many lines from the show your students can quote?

This resource uses the worldwide pervasiveness of the show as a context to explore estimation and problem solving, with a focus on identifying any assumptions that are necessary.

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 – Dave Pratt

About you
At 21, I left university to start training as an actuary but after nine months I was finding office-life frustrating. I tried teaching, loved it (most of the time!) and continued for 14 years. My main formative experience was at Trinity School in Leamington Spa, where for ten years I was given the encouragement and scope to learn the profession by trying things out and making mistakes.

This school was one of the first in the UK to have a computer. This inspired me and a bunch of colleagues to buy our own micro-computers in the days when you had to build them yourself. I remember how we would take these little monsters into school each morning and take them home again each evening. Those were pioneering days when teachers and kids were building stuff together.

In the early 1980s, I was writing mathematical games which, when I look back, were quite revolutionary. Of course, none of the machines on which those games ran exist any more. I became inspired to design Logo microworlds. My first was *Newton*, in which students needed to invent *Newton's Laws of Motion*.

That led me to the University of Warwick, working alongside some wonderful colleagues. Mostly, I was lecturing on the secondary mathematics PGCE and the old BA (QTS) courses. I began to study how children's mathematical thinking was shaped by the digital tools I was designing. I also returned to a life-long interest in probabilistic thinking, which became the focus of my PhD, awarded in 1998.

In 2007, I was offered the post of Professor of Mathematics Education at the Institute of Education, University of London. I am fortunate once more to be working with some brilliant people. My focus now is largely on my research and that of my doctoral students, who are *teaching me* lots of new ideas.

The most recent use of mathematics in your job was...
From time to time, I take on a new programming task. It is pretty obsessive when I do, so I try to choose my moments carefully these days. The most recent programming project was designing and developing Deborah's Dilemma as a tool to explore mathematics and science teachers' risk-based decision-making.

For me, programming is a type of mathematising. The programmer is faced with a series of complex logical conundrums in a quasi-algebraic language. I guess it misses out on the proof aspect of mathematics, which is so important, but it provides a creative outlet for mathematical thinking.

Why mathematics?
The real breakthrough came when I was 16, starting out on A Level mathematics. Up until then I had been pretty good, but once the mathematics became rather more formal it seemed my way of thinking about mathematics stayed good while most of my peers were struggling. I started defending mathematics as a beautiful discipline during debates with friends. Proof still gives me goose pimples - not sure why. I suppose some of my mathematics education colleagues would say I started building a mathematical identity for myself. I really felt I deeply understood every single bit of A Level mathematics - and continued thinking that until I had to teach it!

Some mathematics that amazed you is...
Well, back to my programming as mathematics theme… When I switched to programming in Logo I had to grapple with recursion. I had loved the idea of mathematical induction at school and university but it was a significant intellectual challenge to relate this to recursion and to learn how to gain mastery over it so that I could use it creatively in developing microworlds. The elegance of recursion is astounding.

A significant mathematics-related incident in your life was…

I remember attending my first lecture as a student at university. Some guy at the front of the hall stuck up his hand and offered an answer when I didn't even understand the question. I realised this was a different world and I'd better shape up. Three years later, I'm sorry to say, I took secret pleasure in getting a better degree than him!

Who inspired you?

So many people… My parents of course, who even as solid working class, had the wisdom to encourage me in academic matters… Peter Hastings who was the principal at Trinity School, and who inculcated me into a vision of education that has never left me… Ronnie Goldstein who introduced me to Logo and became a life-long friend… Janet Ainley and Richard Noss: Who could ask for better research colleagues and friends? … And finally, Seymour Papert and Andy diSessa, whose theoretical frameworks of *Constructionism* and *Knowledge-in-Pieces* respectively have influenced my thinking so profoundly.

The best book you have ever read is…

I don't really worship books like some people. I tend to read them once and move on. I've scarcely ever read a book twice except maybe for reference. So, I think the key ideas infuse osmotically into my thinking but I forget the source. One book that I really enjoyed happened to be on the shelf in the maths office at Trinity School. I read for the first time about Cantor's infinities and was pretty transfixed. Perhaps it was Kasner and Newman's *Mathematics and the Imagination* but I really am not sure. And of course, there was the extraordinary *Mindstorms* by Seymour Papert, which I read at a time when I was trying to come to terms with the tension between Piaget's deeper lessons and my own teaching approaches. *Mindstorms* helped me to envisage a resolution to that tension though that resolution has not been entirely realised.

If you weren't doing this job you would…

Perhaps I would still be gambling on people's lifespans as an actuary. If so, I would have been much better off financially! In my dreams I might be a professional bridge player but I suspect I would not earn very much if the dream were real. My daughter says I should write children's books but she probably remembers the stories from her childhood through an unrealistic nostalgia. To be honest, I would not swap my job for any other, but that might only be lack of imagination.

You might like to look at the Research Study Modules, one of which is based on an article written by Dave Pratt and Richard Noss.

A resource for the classroom – Football Crazy

I was heartened to read in a recent issue of the Secondary Magazine that the students said 'maths was about logic and thinking and not just numeracy'.

I have been trying out some different ways to encourage my Year 7 pupils to be logical, so this issue's resource is a downloadable logic puzzle. In my ongoing attempts to spread the rumour that I am a real person who exists outside the maths classroom, the logic puzzle uses the context of my favourite football team – I'm sure it wouldn't take too many clicks of the mouse to change it in the unlikely event that your team is different!

West Ham United scored an impressive 3 - 0 victory last Saturday, with the first goal going in after just three minutes.

West Ham's Number 3 scored with a header, and the player who scored with a volley scored after 78 minutes.

Steve managed to get himself on the scoresheet, as did Pete, who scored a well-taken penalty.

West Ham's Number 8 managed to score, but he was not the player who scored after 44 minutes.

Tony, West Ham's Number 6 was delighted to have scored his first goal of the season.

Can you deduce each player's number, how he scored his goal, and the time of the goal?

Rather than just giving this puzzle to my pupils, I tried to structure the activity for them. I gave them only 30 seconds to read through the text and then covered up most of the screen so that they could not continue to work on it! Pupils then had two minutes in their pairs to decide how they were going to organise themselves to work on the task, after which I took some feedback.

Most pairs had decided that they would need a table to record their results and although they hadn't necessarily worked out what the columns would be, they had an idea what to look for when they revisited the puzzle. Although I have included a suggested results table on the second slide, no-one used this table as they had made up their own.

At the end of the task, we spent a very short time trying to identify some of the 'easy' facts to put in the table, and some of the more difficult ones. The students were also able to talk about their strategies as they solved the puzzle.

Next week I am going to give them a table of results and ask them to write their own clues. If you have tried something like this – why not tell us about it here?

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5 things to do

- If you are within easy reach of Bath Spa University, why not go to the Bath ATM evening meeting on Thursday 3 November (18:00 – 19:30) when Barbara and Derek Ball will lead the meeting focussing on Rich Task Maths?

- This might be the time of year to join a professional association: you can view a full list of NCETM partner organisations here. Many of them produce regular journals, have Twitter feeds and Facebook groups, organise CPD events and conferences – and much more!

- Gresham College holds a regular series of free evening lectures on mathematically-related subjects, in the City of London. If you have ever wondered 'How fast can Usain Bolt run?' or are interested in 'The memoirs and legacy of Evariste Galois' then you can find full details on the Gresham College website.

- Many departments are currently analysing GCSE results and using this data analysis as part of their ongoing self evaluation. The NCETM Excellence in Mathematics Leadership microsite has some ideas about self evaluation. Case Study 3 contains a 'Maths on Track' document which may be useful for your analyses.

- 31 October is Hallowe'en. You could plan to use the Up2d8 Maths resource A big squash as a functional task which also enters into the spirit of the season! Alternatively, you could look at another Up2d8 Maths resource, Remember, remember the 5th of November.

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Tales from the classroom

We've been gearing up for a department review this month. Our management team have decided to carry out reviews to support them in building a picture of what's happening across the school and maths is one of the first departments to be 'done'.

Inevitably there was a bit of tension and unease as the three-day review period approached. We knew that there'd be lesson observations, interviews with post holders and students, exploration of data and a 'work scrutiny' of some exercise books. No matter how many times SLT said that this was about finding a baseline to move forward from, we couldn't help feeling that this was about judging us, particularly as our results this summer weren't as strong as the previous year and were a fair way below English.

We all made a real effort to be honest about what was happening, but also to be clear about what it was we, as a department, hoped to achieve. We were proactive in describing our vision and each of the post holders had a plan which detailed how they would help the department move towards that vision.

Lesson observations are never really enjoyable but, having pushed our vision for problem solving and discussion to be an integral part of mathematics teaching and learning, we maybe felt able to take more risks than we otherwise would have.

My year 7, set 2 (who I'd only been working with for three weeks at this point) were working on sequences. We'd done a lot of work looking at structure, counting dots and explaining how they'd been counted (I found this activity and this PowerPoint were really useful), and I felt we were ready to move on to finding the nth term. I gave them this matching activity with the dot patterns blown up to A3 so that they had space to write.

I was delighted that the risk paid off. Almost all of the class, with little input and absolutely no direct 'telling' from me, matched the descriptions to the patterns and managed to complete the missing cards. I had them working in pairs so they were able to cut the A3 into four sections and each stick two patterns in, so there was even evidence of the activity for the work scrutiny too! Their homework was to draw their own dot pattern and write four descriptions for it, including an algebraic description.

I know this isn't the same as finding the nth term from a number pattern, and I know that the way that I've set out the dots leads them towards the rule, but I can't help feeling that it's a better way to explore generalising than getting them to look at the difference and then add or subtract. I also felt that I'd been true to our beliefs and vision during a lesson observation and was pretty chuffed with that!