Secondary Magazine Issue 58

National Centre for Excellence in the Teaching of Mathematics

Welcome to Issue 58 of the Secondary Magazine. Easter? When was that? It's now full steam ahead for summer examinations. Are you doing more revision than your pupils? This issue provides some articles about revision and some other features to prove that you can do other things in the summer term!

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From the editor

In the words o f the song – 'so long, farewell, auf wiedersehen, adieu'. It is with some sadness that I am writing the last issue of the Secondary Magazine from the current editorial team. Very best wishes to the new team – I look forward to reading the coming issues. The current team have produced Issue 11 through to this Issue, number 58, so it seems appropriate to reflect upon some of the high points of the past 48 issues which have spanned nearly two years.

Issue 11 started with a reflection upon the announcement that there would be no requirement to complete mathematics coursework at GCSE. So, two years on, how do we feel about this? I am not aware of any colleagues who are 'missing' the hoops that pupils felt they were jumping through to get their grades – pupils now have an entitlement to access the process skills at Key Stage 3 and the 'new' GCSE specifications for first teaching in September 2010 include assessment objectives that require pupils to 'Select and apply mathematical methods in a range of contexts' and 'Interpret and analyse problems and generate strategies to solve them'. In Issue 11 we asked: 'So what will you do with the extra curriculum time gained? How will you give pupils the opportunity to solve problems and experience the pleasure of mathematical discovery?" How would you answer these questions now?

Issue 23 received a lot of comment at the time, not least from colleagues! Are you a XXX teacher? talked about the default setting of many mathematics lessons in the country - eXplanation, eXample, eXercise. The article went on to talk about the 'connected, challenging' view of teaching as described by Malcolm Swan in his book Improving learning in mathematics: challenges and strategies. What sort of teacher are you?

In 2009, Issue 26 focussed on Functional Mathematics. It seems strange that we needed to write this article so recently, now that Functional Mathematics is about to be incorporated into the GCSE examination. Have we made progress with the idea of Functional Mathematics in our classrooms? In Issue 34 we considered the news that the requirement to have a separate Functional Mathematics qualification to get a GCSE was dropped we said: "I know hardly anyone involved in mathematics education who thinks that 'teaching to the test', reducing maths to a series of algorithms to be applied without real understanding, is the way that they want to teach. Functional Skills and the new GCSE give us an ideal opportunity to break out of this habit and to continue to develop new, problem-solving behaviour both for ourselves and our students." How does that look in your classroom?

More recently, in Issue 47 we talked about the QCDA publication, Engaging mathematics for all learners. This article seems to tie together some of the themes above: removing coursework whilst encouraging students to become functional mathematicians in a wide range of contexts within and beyond the classroom. It is a constant, exciting challenge to give students a positive, engaging mathematical experience in the classroom – what an interesting and satisfying career we have as mathematics teachers!

Up2d8 Maths

The first London Marathon took place on 29 March 1981, with 6 625 runners completing the course. You might remember the American Dick Beardsley and Norwegian Inge Simonsen winning the men's event dramatically, holding hands as they crossed the finish line in a dead heat. The marathon has since grown enormously with many runners raising money for charity. The sponsors claim that the London Marathon is the biggest fundraising event in the world.

This resource uses the marathon as a context for students to set up mathematical models: firstly, to decide for how long they could keep up with the London Marathon course record holder; and then to decide whether driving or running is the faster way to get around the marathon course!

Download this Up2d8 Maths resource - in PowerPoint format

The Interview

Name: Sarah Gould

About you: I qualified as a Chartered Accountant in 2000. Following work in practice, I moved into the private sector working for Last Minute.com at the time of the internet boom followed by work for media organisations including Dennis Publishing. Two and half years ago I relocated to Cornwall where I moved into the public sector becoming the Financial Controller at the Royal Cornwall Hospital.

The most recent use of mathematics in your job was… Quarter end accounting. Calculating capital charges on future capital investment.

Some mathematics that amazed you is… Quadratic equations. I think they are so clever but simple. I use these a lot in my job.

Why mathematics? I like the fact that it is tangible – it balances.

Your favourite/most significant mathematics-related anecdote is… the wise man who, as a reward, asked his emperor for one grain of salt on the first chess board square, and two on the next, and four on the next etc...

A maths joke that makes you laugh is…
Q: Why was 6 afraid?
A: Because 789.
Something else that makes you laugh is… my husband!

Your favourite television programme is… Spooks.

Your favourite ice-cream flavour is… Strawberry

Who inspired you? My Dad – he had a very hardworking work ethic. He was able to communicate with everybody at all levels, which is a very important thing to be able to do as an accountant. You cannot just bombard people with maths.

If you weren't doing this job you would…currently be a mother.

Focus on…risk and chance

- Wolfram Mathworld says that 'the Möbius Strip', also called the twisted cylinder (Henle 1994, p. 110), is a one-sided, non-orientable surface obtained by cutting a closed band into a single strip, giving one of the two ends thus produced a half twist, and then reattaching the two ends (right figure; Gray 1997, pp. 322-323). The 'strip' bearing his name was invented by Möbius in 1858, although it was independently discovered by Listing, who published it, while Möbius did not (Derbyshire 2004, p. 381). Like the cylinder, it is not a true surface, but rather a surface with boundary (Henle 1994, p. 110).

- August Ferdinand Möbius (1790 – 1868) was a German mathematician and astronomer. His father, a dance teacher, died when August was three years old, and Möbius was raised and home schooled by his mother until he was 13. A detailed biography of August Möbius can be found at the MacTutor History of Mathematics archive.

- Plus Magazine offers this for that special mathematician in your life… If you know anyone who might appreciate a rather geeky Valentine tribute, try this. Make two Möbius strips, with one twisted clockwise and the other twisted anticlockwise. (It won't work unless you get this right.) Stick the two loops together, at right angles to each other. Send this to your inamorata, with instructions to cut along the middle of both loops. (When you get to the join, cut through both loops.) What you get is a mathematical Valentine!

- It's unlikely to surprise you to find that the Möbius strip featured in the work of MC Escher.

- The properties of the Möbius strip have found a practical use in a number of industries. Wikipedia states that, "Giant Möbius strips have been used as conveyor belts that last longer because the entire surface area of the belt gets the same amount of wear, and as continuous-loop recording tapes (to double the playing time). Möbius strips are common in the manufacture of fabric computer printer and typewriter ribbons, as they allow the ribbon to be twice as wide as the print head while using both half-edges evenly."

- The musically-minded of you might appreciate this video of Bach's *Canon 1 à 2* (from *A Musical Offering*) written on a Möbius strip.

- As with much of mathematics, the Möbius strip needs to be experienced rather than just read about. Get a piece of paper and make yourself one, then…

    - challenge a class to colour only one side
    - ask a class to predict what will happen when it is cut in half through a line parallel to the edge (and then repeat the question and the cutting in half on the resulting band)
    - ask what would happen if, instead of cutting in half, the strip is cut following a line parallel to the edge but a third of the way across.

  What happens if extra twists are included? Or if the cuts are made different fractions of the way across?

An idea for the classroom – Probability cards

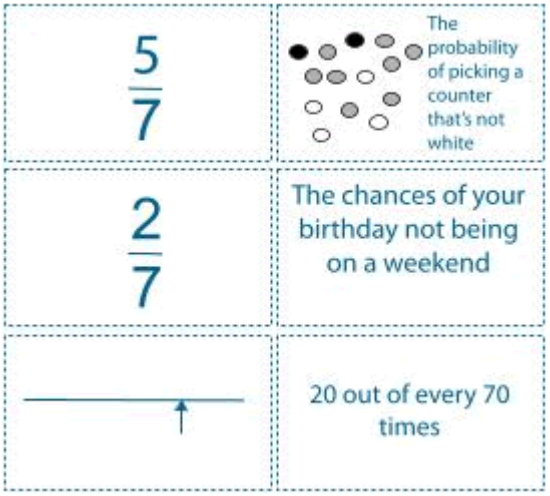
Have you bought a lottery ticket or a premium bond? Did you bet on the Grand National or the Boat Race? If your answer to any of these questions is 'yes' then there is some element of probability involved in your life. Some people would say that we are taking calculated risks all the time – we focused on risk and chance in Issue 56.

I have always enjoyed teaching probability; there is always plenty of discussion in the classroom as pupils try to distinguish between genuine chance and events where there is some skill involved. An 'always, sometimes, never' statement like:

The chance of me winning a match against Mike Tyson is 1/3, because I could win, draw or lose.

usually causes some amusement in the classroom but also exposes a genuine misconception held by many pupils (not that I could win, but that the outcomes are not equally likely!!).

The resource in this Issue is a set of probability cards.



Pupils can cut out the set of cards themselves and group them to show different representations of the same probability. Having grouped, and talked about the cards, pupils could then:

- stick one 'set' into their own book and make some comments about why those particular cards form a set
- make an annotated poster of all the grouped cards
- make up a new 'set' of cards for their own fraction
- make up a new 'set' of cards for a fraction provided by their teacher
- design a set of probability dominoes using the Tarsia software.

Have you got some good ideas for uncovering probability misconceptions? Why not share them here?

5 things to do this fortnight

- The exams are close! Do your students know **how** to revise? There are many revision sites on-line. Mr Barton Maths offers some simple strategies that students can use to make their revision more effective and there are plenty of past papers freely available from Dr Zargle. There are many more ideas in this departmental workshop from Issue 6 of the Secondary Magazine.

- Do your students know **what** to revise?! Many exam boards offer a question-level breakdown of each student's performance (and those that don't will still publish an examiners report) showing which areas of mathematics students find particularly challenging. Giving students access to this breakdown can help them focus their revision time on their own high priority topics.

- Looking past the exams, you might feel the need to refresh and inspire yourself. On 8 June, in London, the Mathematics in Another Dimension Conference 2010 aims to arm all teachers and professionals with a new insight into the learning and teaching of mathematics. During the day you will have opportunities to see, hear and do mathematical activities, use resources and be treated to demonstrations from prestigious classroom practitioners and world famous professors!

- The following day provides another opportunity to refresh yourself and think about mathematics and pedagogy. The Poole Grammar School Mathematics Department, with the Further Mathematics Support Programme and the NCETM are proud to present Making the Connection. This teacher enrichment conference is for teachers of mathematics from the South West and beyond. The keynote speech – Only Connect: who connects what and how? – will be given by Professor John Mason, Open University, Author of 'Thinking Mathematically'.

- Do you fancy teasing an 'Oss' on May Day? If so, you need to get to Padstow in Cornwall for the traditional festivities. Celebrations begin early morning on May Day with the stable doors opening to let the Oss appear onto the narrow streets. First the procession of the Obby Oss Clan goes around the harbour crowded with thousands of onlookers, then up the narrow lanes – even into gardens and houses. Festivities go on all day and into the evening. There is even a Children's Wee Oss. The Padstow Obby Oss is one of the oldest surviving customs in the country and is believed to be an ancient fertility rite marking the coming of summer.
  If you can't make it there's an archive video of the festivities, together with a more recent one.

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Diary of a subject leader

Real issues in the life of a fictional Subject Leader

I always find revision a bit of a challenge. In an ideal world, my students would all have copies of past papers and be working through them. They would be asking me for help when they are stuck, or just checking if their workings pick up the method marks, or their explanation is good enough. I really like the idea of students getting into the habit of using the mark scheme, because they begin to see the crucial elements of a model solution – even if they think it trivial such as putting the "0" in after £24.5_ etc. It does bring home to them that precision and detail matter.

Now all that could just be a personal penchant, developed in my own learning of maths. When at school, I was a keen bunny in maths lessons but never really thought about how I learned – I just did the answers. When it came to revision I had no structure to my notes, nor did I think about using a revision guide. I turned to my Dad – and was lucky to be able to. He would just give me a pile of past papers and say, "I'll be in the garden". I would then return to my room and have a stab at a past paper to the dulcet tones of an over-revved, frequently backfiring Suffolk Punch lawn mower breaking through peace of an early spring morning. So idyllic! When I was done – usually in far less that the stipulated time and because of the blankness of my papers, not my flare – I would descend through the kitchen and into the garden, whereupon I would have a number of excellent diversionary tasks: empty wheelbarrow, hold washing line away from mower, empty compost bin etc. And then I would really begin to learn maths with hands smelling of cut grass and petrol.

For me this approach really worked. I had superb, individual, instant teaching that was very specific to my need. That may be why I like to think my students can revise in this way. But, they refuse to buy past papers, and if I give them to them, they copy the answers from the mark scheme, so they can appear to have worked when all they have done is socialise. That may sound harsh, but that is what happens. Perhaps a different approach is needed?

Two weeks ago a colleague and I mixed up our Set 1 and Set 2 students. I had already taught my Set 1 vectors just before Christmas. I gave them 30 minutes to plan an individual lesson that they would teach to a friend in Set 2. We teach these groups last lesson on Friday every week – our favourite graveyard slot! The next Friday, when Freddy Kruger came knocking, we hit him with our paired teaching session! Both groups are very male-dominated – challenging and minimising this is a weekly challenge, and we made some errors with the student pairings. At the end of their teaching and learning all students had to answer three past-paper questions. Every student had a really good go at the questions, a quick round of "What went well" and "Even better if" revealed that students respected the efforts each other was making and felt empowered to ask questions of each other. The whole process, but particularly the feedback, has forced my thinking about helping students revise. I'm now thinking about other AfL tactics – the fish bowl, the model answer, sequencing an answer, student experts, skills-market and of course, a bit of help from me!

For a dedicated, or perhaps just motivated student, I still think lots of past papers is the best way to revise, and I have seen many, many students do this very successfully, but perhaps I now have too many students that are too far away in terms of motivation to make this approach in any way effective. Grating though it feels, to have to provide not just the materials, subject knowledge and insight but also to have to do the motivation as well, I have no choice. Yes, it does make my students less independent, but there aren't too many marks for independence on current maths papers. And my students aren't going to learn independence in the next six weeks.

But revision does have its upside – every time I cut the grass, I think back to those spring mornings of maths revision, that actually have ended up meaning far more to me than the sum total of the maths. Roll on study leave!