Welcome to Issue 43 of the Secondary Magazine.

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From the editor

Did you see this a few weeks ago? I haven't read the report and I wasn't at the British Educational Research Association (BERA) conference, so I'm having to judge everything by the BBC coverage, but still I found myself thinking about this and wondering how valid the headline is.

Having tracked down the original press release, the first thing I noticed was that the study had carried an analysis '…of 3 000 secondary pupils' performance in algebra, ratio and decimals test' and from the study of these topics the press release concludes that 'there has been little overall change in maths attainment since 1976'.

I was at school in the 70s and 80s and have very strong memories of maths being drilled into me. I also have memories of the School Mathematics Project (SMP) booklets and thinking that I'd had a great lesson if I managed to complete a whole booklet!

I was struck by how much what we value has changed and wondered what the modern students taking the exam last year must have thought of it. Is giving students a test carried out 30 years ago and analysing the results really comparing like with like? A study comparing English, maths and chemistry GCSEs and A Levels in 1975 and 1995 by the School Curriculum and Assessment Authority suggested that '…standards shown by the majority of candidates have risen because of the greater emphasis on breadth and the accessibility of questions'.

I hope that we are moving away from the idea that maths is just about being able to do the content – manipulating equations or adding fractions for example – and are moving towards a subject that values developing reasoning, problem solving, analysing, communicating and other high-level process skills.

Of course, not everyone's maths lessons were like those that I remember. I'm sure there were some maths classrooms where the teacher created an environment buzzing with original, creative, high-level thinking. I'm also sure that some people (I'm guessing that this is probably you and me!) were able to develop the higher order skills by repeatedly practising question after question where little changed except for the numbers.

But I want more for my students now than to be able to regurgitate algorithms and methods and to hope that they develop the process skills through repetition. I want them to construct their own understanding rather than to give them mine (as Malcolm Swan might put it), to know what to do when they don't know what to do and to see maths as a subject in which there is much to discuss, rather than seeking the answer from the back of their text book.

I'd be really interested in seeing a comparison in students' ability to problem solve, to apply those algorithms, to think creatively in a mathematical context. I believe that the modern maths classroom is a place where both the measurable ability to work with fractions, decimals, ratio and algebra is entwined with a less objective ability to generalise, to think creatively and to problem solve.

What do you think?

Up2d8 maths

The fortnightly Up2d8 Maths resources explore a range of mathematical themes in a topical context. The resource is not intended to be a set of instructions but rather a framework which you can personalise to fit your classroom and your learners.

Jamaican athlete, Usain Bolt, is never far from the sports pages. Having already achieved legendary status for the enormity of the winning margins at the Beijing Olympics, Bolt broke both of his own world records at the World Championships in Berlin. He says that he is aiming to run the 100m in 9.4 seconds.

The suggested task is based around exploring the biomechanical analysis from the 100m, 200m and 400m finals in the World Athletics Championships, along with world records for other distances. Is Bolt's target of 9.4 seconds attainable – after all, he ran the second half of the 200m in 9.27 seconds? Students are first asked to calculate the average speed for each event and are then asked to use the analyses to decide on a distance that would give the highest average speed and to justify their decision.

This resource is not year group specific and so will need to be read through and possibly adapted before use. The way in which you choose to use the resource will enable your learners to access some of the Key Processes from the Key Stage 3 Programme of Study.

Download the Up2d8 resource - in PowerPoint format.

The Interview

Name: Charlie Peake

About you: Charlie has recently been appointed head of maths at a large school in Gloucestershire. After graduating with a degree in mechanical engineering from Leeds University, he trained to become at teacher. He has worked in a variety of Devon schools and has most recently been a SNS maths consultant. He has now decided to return to the classroom.

The most recent use of mathematics in your job was... Obviously, counting the number of free periods I had been allocated on my new timetable.

Some mathematics that amazed you is... The Fibonacci sequence, its links to the Golden Ratio and its application within art and science over the last millennia. However, on a more mundane topic, the conversion of a recurring decimal into a fraction…a great and simplistic use of algebra!

Why mathematics? The variety. There are so many numbers to choose from and I'm yet to use them all.

Your favourite/most significant mathematics-related anecdote is…
I didn't discover the beauty in maths until relatively late on in my teaching career. It certainly wasn't at school, college or university, where facts, figures and procedures had been drummed into me. In order to appreciate the subject you must be given time to do so. This includes an opportunity to discuss problems and possible solutions with others. As a consultant, I frequently met teachers who were able mathematicians but who were yet to fall in love with the subject, often because the job had never given them the chance or time to reflect and play with numbers. Surely this is true for many students too.

A maths joke that makes you laugh is… A statistician is someone who is good with numbers but lacks the personality to be an accountant.

Something else that makes you laugh is…
My three-year-old twin daughters – a great age. They do, however, sometimes have the reverse effect on me.

Your favourite television programme is… The Apprentice, but recently I've become strangely hooked on Come Dine With Me.

Your favourite ice-cream flavour is… Can't remember – it makes my teeth hurt.

Who inspired you? Anyone with skill, confidence, empathy for others and a sense of humour.

If you weren't doing this job you would… I've often stared through the classroom window at the bloke painting lines on the football pitch, thinking that I'd rather be doing that. However, he's probably also been given targets to meet.

Focus on...coordinates

- The commonly-used Cartesian coordinate system was first used by René Descartes in 1637 (it was also independently developed by Fermat, although Fermat's version, which he didn't publish, used three dimensions) in the appendix of his Discourse on the Method. Descartes introduces the new idea of specifying the position of a point or object on a surface, using two intersecting axes as measuring guides. He further expanded this idea in La Géométrie.

- Descartes' contributions to philosophy, mathematics and science are well known but it is perhaps less well known that he was the first to use superscripts as notation for powers (such as the 7 in x^7).

- *The Discourse on the Method* (the full name of which is *Discourse on the Method of Rightly Conducting One's Reason and of Seeking Truth in the Sciences*) in which Descartes explores Cartesian coordinates, is also the source of perhaps his most famous quote, *I think therefore I am*.

- The invention of Cartesian Coordinates is one of the foundations which allowed Newton and Leibniz to develop calculus.

- In Cartesian coordinates in two dimensions, the coordinate axis split the plane into four quadrants. The quadrant in which both x and y are positive is the first quadrant and the second, third and fourth quadrants are labelled anticlockwise from here. In three dimensions, the first octant is the one where x, y and z are all positive but there is no convention for naming the other seven octants.

- The polar coordinate system uses a distance from a fixed point and an angle from a fixed direction as the two variables. They first appeared in their recognisable form in the mid-17th century, with the Belgian mathematician Grégoire de Saint-Vincent and the Italian mathematician Bonaventura Francesco Cavalieri independently using them. The name *polar coordinates* has been attributed to the Italian mathematician Gregorio Fontana (1735 – 1803). You can see the relationship between polar and rectangular coordinates in this demonstration from Wolfram Mathworld.

- Cylindrical coordinates are a three dimensional extension of polar coordinates in which the distance from a fixed point and an angle from a fixed direction, are combined with a height above a fixed plane to allow three variables to be represented. Although there is no single convention for writing the three coordinates, (ρ, φ, z) are commonly used.

An idea for the classroom – 'always, sometimes, never' questions

Have you been following the thread on the NCETM Secondary Forum, Favourite Always, Sometimes, Never questions? I'm grateful to NottsHead for drawing my attention to the Sixth Sense website in this community.

I expect you are familiar with 'always, sometimes, never' activities which have been used in the Standards Unit resource Improving Learning in mathematics: challenges and strategies. In case you are not a fan yet, the idea is that you pose a statement such as:

> *To add two fractions together you add the top two numbers and the bottom two numbers. Is that always, sometimes or never true?*

.. and students have to decide whether the statement is always, sometimes or never true.

So it would be tempting for teachers of mathematics to say that this is never true, whereas a lot of my Year 9 group would like to argue that it is always true! I think there is a middle way…

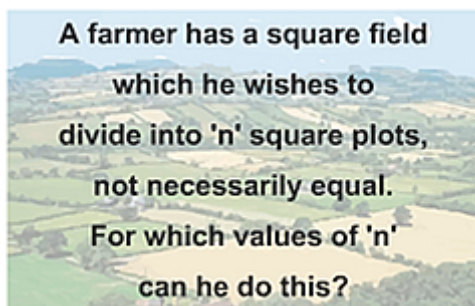The introduction to the Standards Unit resource describes these activities as 'evaluating mathematical statements':

> *"Learners decide whether given statements are 'always true', 'sometimes true' or 'never true'. They are encouraged to develop rigorous mathematical arguments and justifications, and to devise examples and counterexamples to defend their reasoning."*

The Sixth Sense website, which is for Oldham Sixth Form College, gives some possible 'always, sometimes, never' questions and some possible answers. These questions would make some good starters in the classroom, for example,

$$\frac{a}{b} = \frac{a+1}{b+1}$$

would be accessible, particularly if pupils start by trying out some numbers and then refining their arguments.

Before you navigate away from that website, it is worth trying a few of the other pages. At the time of writing, the puzzle of the week was:

A farmer has a square field which he wishes to divide into 'n' square plots, not necessarily equal. For which values of 'n' can he do this?

I hope you enjoy using the site.

5 things to do this fortnight

- The NCETM is planning a project, The First Five Years - an entitlement to CPD, to address professional development opportunities for teachers in the first five years of their careers, and is holding a number of 'think-tank' meetings across the country in October and November: we hope you will be able to attend.

- On 6 November at the Royal Statistical Society, the IMA is hosting a conference on the History of Mathematics. The conference will be dedicated to tracing the history of social, professional and academic networks which in some way influenced the creation of new mathematical concepts or disciplines. East London, where the conference will be held, was the fermenting ground where one of the first mathematical societies was founded, the Spitalfields Mathematical Society (1717). The history of the area has inspired, in many ways, the contributions to the conference, and it is hoped that both mathematicians and historians of mathematics will find this a fascinating opportunity to explore the ways in which mathematics developed from its applications and in which applications inspired the creation of new mathematical techniques.

- Have you thought of attending the BCME conference Mathematical Progressions as part of your CPD? In 2010, all the leading UK mathematical organisations unite in a single conference dedicated to mathematics and mathematics education. Mathematical Progressions will take place at the University of Manchester from 6-9 April, and will offer delegates a rich and rewarding experience and the opportunity to mix with colleagues who share their interests, as well as the chance to broaden horizons by meeting new friends with other specialist interests. For delegate booking information contact The Association of Teachers of Mathematics.

- Are you looking for a stimulus for discussion in a department meeting? Are you struggling to understand some of your students' misconceptions? This video of AST Tom Rainbow talking with a small group of students is likely to provide food for thought.

- On Sunday 11 October, Ashton Conker Club in Northampton hosts the World Conker Championships. The competition first took place in 1965 and has grown year-on-year ever since. Nowadays, teams from all over the world meet for the competition. The competitors play on eight white podiums in the playing arena and go through rounds until the winner emerges and is lead to the Conker Throne and crowned with conkers.

Diary of a subject leader

Real issues in the life of a fictional Subject Leader

Standing in Monday morning briefing this week, I listened to the headteacher reel off the usual reminders and lists – make sure every student has their top button fastened and seven stripes of the tie showing…at which point I begin to wonder how the ensuing confrontation is going to help me hit the targets next August. My eye wanders to some other team leaders in the room and I know they are thinking the same.

When we are done, I check my pigeonhole. On top of all the flyers is a memo from the head asking me to list all units of work where students have the opportunity to use workplace skills, all units where they…?? (Return by end of tomorrow!) It is apparently part of the all-new, shiny self-evaluation form (SEF).

It gets me thinking about my department SEF and eventually back to a conversation I had with a head of mathematics in a neighbouring school. She had taken on the challenge of leading a totally new team in a fairly challenging school where mathematics was the objective in the School Development Plan. Starting the year with a completely new team of mathematics teachers, and with 75% of Year 11s commiserating on their Grade U's in the most recent module examinations, I had often admired her courage but also felt for her partner. With a small cohort of about 120, every borderline student mattered. Her team were really focussed on the 18 students that were nearest to the D/C line. They were clearly making a real effort, more perhaps than their students.

I'd met up with her after the results. She missed her target of 54% by 2%, and was quite deflated. She explained the impact that maths was having on the whole school 5+A*-C inc. Eng/Ma. I commiserated with her but in the next five minutes she revealed that her team had a positive residual, and had been successful with 8/18 borderline students. I quizzed her on her deflated feelings. It appeared that her headteacher had been hoping for more, and she had really followed that emotional lead. I bought her another drink and told her that her headteacher was lucky that she stuck the year out (the furniture in this particular watering hole had previously been party to some fairly eyebrow-raising tales).

Going back to my own team after that rather deflating briefing, I was ready for a full whinge from both barrels. But…I remembered how my colleague had picked up on that emotional lead from her headteacher. Was I falling into the same trap? In the second week of the term, did I really want my own team to focus on the negatives, or did I want them to maintain their buoyant, enthusiastic approach, which had already been noticed by students?

From a wider perspective, how does my emotional state and how I react to the stress of my role help my team to improve their game? Yes, I support them when they ask, and I try to bring out their positives when it comes to performance management. However, if I want them to get more from our students, perhaps I need to contain my own negative reactions and make an effort with my own emotional leads. Will I be happier next September if I worry less about my own negatives and focus more on supporting my team everyday, by looking for the best in them and the best in their students? I'm not sure, but I won't feel any worse!