Secondary & Further Education Magazine 97

National Centre for Excellence in the Teaching of Mathematics

Welcome to Issue 97 of the Secondary Magazine (incorporating FE)

97 is the largest prime under 100.

$$2^4 + 3^4 = 97$$
$$4^2 + 9^2 = 97$$

As Easter approaches, this issue aims to respond to some topical concerns and provide some items to engage you before the chocolate overdose kicks in!

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From the editor: all change?

My Dad could never understand it when I spent time making changes to the mathematics provision at my school. *Why do you need new textbooks?* he would say, *Maths is maths isn't it?* His words have stayed with me throughout my teaching career so whenever a potential change comes into view, *Maths is maths isn't it?* helps me to consider how much of a change this will be and what form the change will take.

In recent weeks there have been at least two announcements that relate to mathematics education: first Michael Gove's announcement about the future of GCSEs, the introduction of an average points score showing the progress made by pupils between Key Stage 2 and Key Stage 4, and the proposed changes to the National Curriculum - you can read the text of Michael Gove's announcement (starting at 11.23); secondly, the study published by the Institute of Education (and summarised in a report in The Guardian), which says that England's brightest pupils perform as well as their counterparts in Asian countries at age 10 but by the time they take their GCSE exams at 16, they have fallen behind.

So what do these news items mean for us in school? As teachers of mathematics, enabling our pupils to get the best possible results throughout their school careers should be one of our aims so changes to the curriculum that provide

> *a stronger emphasis on arithmetic and more demanding content in fractions, decimals and percentages, to build solid foundations for*

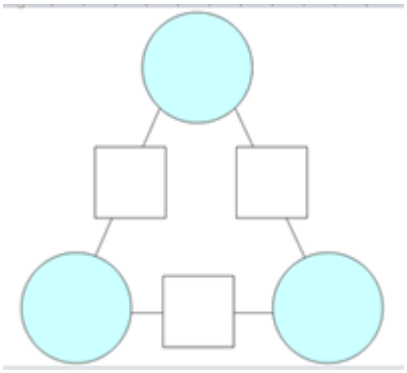
fits in with the idea that Maths is maths isn't it? You can see more detail and respond to the consultation on the changes to the National Curriculum - do have a look and make your views known!

It is a concern that some of our best pupils do not make appropriate progress at Secondary school; does that apply in my school? What could I do about that? *Maths is maths isn't it?* so finding a way to engage learners of every ability is part of the craft of teaching - our professional responsibility (our Tale for this issue focuses on a particular programme to engage low-ability learners).

My vision of mathematics education as providing pupils with the skills that they need to become responsible members of society but also of enabling them to appreciate the beauty of mathematics gives me a good standpoint from which to develop my skills as a teacher, providing powerful learning experiences which enable pupils to fulfil their potential. Working towards this vision, changes in perspective become less dramatic because after all, *Maths is maths isn't it?*

A resource for the classroom – RISPs

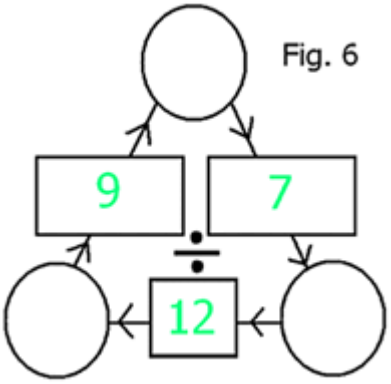
This isn't the first time that the Secondary Magazine is featuring Rich Starting Points (RISPs) by Jonny Griffiths in *A resource for the classroom*. This time, it's *RISP 21: Advanced Arithmogons* that has inspired me.



Having a laminated set of blank arithmogons (see here and here) in a box in the classroom, they are often used with Key Stage 3 classes to practise arithmetic:

Stage 1: I put numbers in the blue circles, define the operation as + or x, and pupils fill in the white squares
Stage 2: I put numbers in the white squares, define the operation as + or x, and pupils fill in the blue circles
Stage 3: Pupils put numbers in the blue circles, define the operation as + or x, and pupils fill in the white squares
Stage 4: Pupils then rub out the numbers in the blue circles, leaving numbers in the white squares, and pass their 'puzzle' to another pupil to solve.

At first glance, this corresponds to the resource on page 1 of the RISP except that the numbers in the RISP are considerably more challenging. And the last one (Fig. 6) was the focus of a long discussion in the classroom (the solutions are in the teacher PDF file):



Having become familiar with the way these arithmogons function, figures 9 and 10 provided some excellent practice with partial fractions:

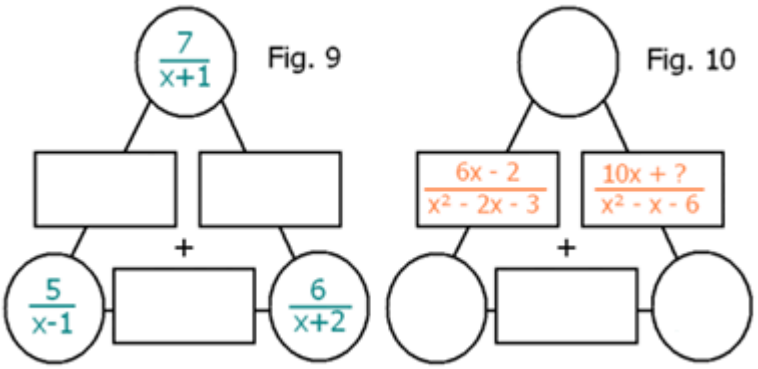


Fig. 9

Fig. 10

...and then back to the stages above replacing numbers with expressions.

Stage 3: Pupils put expressions in the circles, define the operation as +, and pupils fill in the rectangles
Stage 4: Pupils then rub out the expressions in the circles, leaving expressions in the rectangles, and pass their 'puzzle' to another pupil to solve

There are some other great uses of arithmogons in the RISP – do try them and make some suggestions of your own.

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Focus on…revision

How do your pupils revise their mathematics? Do you provide them with lots of the same experiences or do you try to show them some mathematics from a different angle? Does all revision take place at the end of the course or are there some activities built into the scheme of work to consolidate and revise periodically through the year? Do your pupils need to revise because they have forgotten something or because they did not understand it the first time round? Here are some possible sources of stimulus material to enable you and your department to further consider the way you encourage pupils to revise.

The NCETM two-hour learning module on revision techniques may be a good place to start.

The legendary BBC Bitesize mathematics revision site is used by many pupils – do you provide links to this site for your pupils?

mr barton maths.com provides a massive collection of Tarsia jigsaws. Are these a good revision resource for your pupils? Could parents work with pupils to complete a jigsaw as part of their revision?

Some pupils like watching videos – and there are plenty of mathematics revision videos on YouTube. Teacher in my Pocket presents a selection of videos created by the staff and students of The Cooper School, Bicester, designed to help with revision for your GCSE Mathematics.

Your pupils may benefit from trying some of the generic revision techniques featured in The Student Room. Are there any that would particularly benefit them?

A range of past GCSE papers can provide some useful practice for pupils

The NCETM Guidance ('essentials') page looking at intervention for C/D borderline pupils may give you some further ideas.

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5 things to do

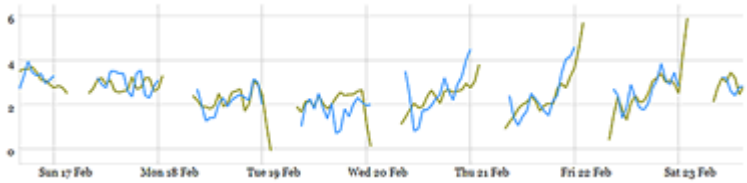
Do you tie yourself in knots trying to refold an Ordnance Survey map? You may have noticed that some newer maps are folded in a different way and are incredibly easy to open and fold up by pulling and pushing diagonally opposite corners of the map. This is an example of the miura-ori method of folding. There are some interesting examples on Google images, and there's more information on the British Origami Society website.

Have a look at the Google Science Fair 2013. You may particularly like the stories of science heroes: well-known mathematicians such as Pascal and Lovelace are included here. There is also a set of posters that can be printed and displayed in your school.

Have you considered becoming a member of ACME (Advisory Committee on Mathematics Education)? Currently ACME is looking for three new members. Applications should be received by 12 April 2013.

Have a look at the new iPad app, Beluga Maths, which is available free from the app store. The website says, *"Learn Maths with Beluga is the world's first truly immersive, adaptive and personalised learning environment for mathematics".*

How happy are you? Mappiness is collecting data about happiness. You can contribute to the data collection by downloading the app from the app store or make use of the real life graphs (you can access your own graphs if you input data).



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Tales from the classroom

How do you work with low ability students at your school? What are the things that you look for? I've been lucky enough to be a part of a new initiative (I know! 'New Initiative' is a pair of words not usually preceded by the word 'lucky'!) called Numbers Count, and it's been an amazing and eye-opening journey so far.

Numbers Count is a programme that started out in Primary classrooms and is just being moved into Secondary. In the first stages it's a 1:1 intervention programme but this moves to be a 1:3 at the end of the CPD making it, to my mind, cost-effective enough to be worth running.

I was convinced that it was needed through witnessing a very short exchange with a year 7 student who I shall call Gareth. I'm sure you know a Gareth? He's in the bottom set for maths but is doing ok in his lessons. He is able to carry out column addition and subtraction, including decomposition. He finds concentrating difficult and will sometimes distract himself/everyone else when he doesn't understand the work but, on the whole, he tries hard.

I thought that Gareth would be a good candidate for *Numbers Count* so I asked him to come along and meet the person who would be training me on the programme.

> Trainer: "Gareth, can you count up in tens?"
>
> Gareth (so quickly that the words almost roll into one):
> "Tentwentythirtyfortyfiftysixtyseventyeightyninetyhundredhundredandtenhundredandtwenty…"
>
> Trainer: "Thank you. Now can you do the same starting at 26?"
>
> Gareth (hands go into pockets): "Erm… er… umm… thirty-four?"

On talking to him Gareth said that he had counted up on his fingers. He'd put his hands in his pockets to hide that he was doing this because he felt that it was 'babyish'.

Watching this blew me away! I've been teaching in secondary schools for 15 years and it's never occurred to me to ask a question as basic as counting on in tens from a given number. I've always just assumed that it's solid in even the lowest ability student but watching this turned me into a counting-on-in-tens-aholic! I talked to most of the students in our bottom two groups and found that this really wasn't that uncommon. Try it with a group that you teach – I'm pretty sure you'll have a similar experience (crossing the hundreds boundary caused the most problems so make sure that you let them go that far).

The problem for me is that this is too low a level to have been on my radar and, now I've identified it as an issue, I have no idea how to address it. I can see the problem, I can come up with activities to practise counting on in tens, but, if they haven't got the concept, none of this practice is worth anything! This is why *Numbers Counts* is, for me, so helpful.

The structure of the term's worth of 30-minute sessions (three of these per week) dedicates a lot of time to diagnostic work, identifying the areas that students find difficult and that are blocking their progress before working with the students to unpick and overcome these issues. The structure is very rigid but with the structure is complete flexibility. I've found myself working with Numicon, Cuisenaire rods, Dienes blocks, coins, number lines… anything to support these students in developing an understanding of number and a way to communicate their understanding to me.

This experience has again made me think about 'intervention'. If I'm honest (painfully honest) with myself and think about the attention given to the bottom set students, I have to admit that they are often very low down my list of priorities. Investing in this type of intervention is expensive (at best I'll be able to work with around fifteen students a year on this programme) but shouldn't these students be a focus? I'm imagining Gareth as an adult counting out change, placing three £1 coins on the counter then trying to count the £10 notes on top of them £3, £13, £23… If, after seven years of formal education, he couldn't do this then why do I assume that he'll 'pick it up as he gets older'?

After a few weeks of intervention Gareth can now count on in tens and hundreds from any given number. We're both very proud of this achievement.