Welcome to Issue 113 of the Secondary Magazine

As the summer strides along, this issue of the Secondary Magazine contains a variety of articles which have some similarity with the 'Back to School' signs displayed in supermarkets and clothes shops from late July onwards! Instead of buying new black shoes and white shirts, delve into this issue as part of your preparation for the new term.

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From the editor – How are you spending the holiday?
Whilst school is out, how do you prepare for the new term? Here are some ideas.

Focus on…Maths Hubs
Following the launch of the new Maths Hubs, here is some more depth from one of these hubs – this might give you some ideas for ways in which you can work with your nearest hub.

A resource for the classroom – a data handling murder investigation
This resource has been reviewed as one of the best resources I have seen to date! So it is worth *investigating* (sorry!) for the new term.

5 things to do
Radical Geometry, the NCETM FE magazine, a MegaMenger, Maths Outside the Classroom, and the NCETM Departmental Workshops all feature in our list of suggestions for the month.

Tales from the classroom: Business mathematics
This *Tale* does not come directly from the classroom but instead is a result of our author's conversation with the school's business manager. This could be interesting!

From the editor: How are you spending the holiday?

Having recovered from the term gone by, and perhaps returned from a spell away, what maths-specific activities might you engage with?

You could think about extending insight, doing a Rubik's Cube, and becoming a mathematical artist, among others things.

For many teachers, the summer holiday is also a chance to take stock of the year gone by and prepare for year to come: part of this reflection may well be re-establishing the principles that lie behind your classroom practice and making the links between the things that you believe and the things that you do in the classroom.

Becoming a mathematician and working mathematically don't happen all at once so you may like to have some small 'bite size' activities that you can use to get your pupils accustomed to being active learners. The [DCSF] Standards Unit publication Improving Learning in Mathematics: Challenges and Strategies (ILIM) articulated the following different types of activities that may be useful to promote active learning in mathematics:

- Classifying mathematical objects
- Interpreting multiple representations
- Evaluating mathematical statements

It may be useful to include some small scale examples of these activities in your first few lessons in September if they are to become tools of your trade in the weeks to come? Here are some suggestions.

Classifying mathematical objects

The activity Classifying Shapes from ILIM might be a good place to start to familiarise pupils with the ideas of sorting and classifying. There are far too many shapes to use with most pupils so make a selection according to the sorting grid that you choose to use. You could choose the grid

SS1 Sheet 3 – Classifying triangles

	No right angles	One right angle
No sides equal		
Two sides equal		
Three sides equal		

and the triangle shapes from the selection
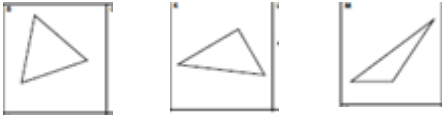
etc

Interpreting multiple representations

These sorts of activities have come to be known as card sorts! It might be useful to distinguish between the card sorts that enable pupils to reinforce and consolidate their existing knowledge such as those you can create by using Tarsia software, and those that can promote learning.

This resource, from the SMILE publication Ratio Makes Sense (page 14), does the latter. Again you may find there are just too many cards for this to be a useful exercise so you could pick out the cards relating to a couple of ratios that pupils find confusing, and then invite pupils to make up a set of cards for a third ratio:

Evaluating mathematical statements

'Always, Sometimes, Never' activities are helpful to encourage pupils to evaluate mathematical statements. It can be overwhelming for pupils to have a large selection of statements, so why not start off with a small number statements that you display? You could choose from this Always, Sometimes, Never activity:

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5 can't be divided by 10	Dividing a number makes it smaller
Multiplying a number makes it bigger	$10 \div 3 = 4$

These four statements might make a good start. You will want to ask pupils to say whether each statement is always, sometimes or never true and then explain their thinking, perhaps in writing or by talking with a partner. This would make a good introduction to some work on calculation.

When working in this way, it may be useful to make your intentions explicit to your pupils: 'We are going to learn how to do a classifying activity today so that we can use classifying activities to help your learning'.

Whatever you are doing this holiday, enjoy the break and let us know how you make that fresh start in September.

Focus on...Maths Hubs

If you are reading this and have no idea what a Maths Hub is – then you can read about them in Issue 112. To give you a different 'flavour' of this new initiative, this article focuses on one of the Maths Hubs and their priorities for the coming year (news from other hubs will feature in future issues).

Balcarras Teaching School is the lead school to shine a light on collaborative working across primary, secondary schools, colleges, universities and individuals across Gloucestershire, Oxfordshire and Worcestershire (hence the name GLOW). The strategic partners of the GLOW Maths Hub are keen to work with successful established mathematics communities across the region as well as ensuring all pupils, teachers and leaders have access to support, research and innovation that will improve the enjoyment and achievement of mathematics.

Key priorities and research projects of the GLOW Maths Hub for the next academic year include:

- helping schools and colleges with the curriculum changes
- improving arithmetical proficiency
- strengthening the teaching and leadership of mathematics
- improving the participation of mathematics post 16
- improving pupils' resilience, and reducing reducing their "mathematics anxiety"
- learning from best international practice, in particular through the England-China Education Research Innovation project.

Research scholarships are also available for practitioners interested in developing and researching innovative practice that:

- improve the participation in mathematics (short and long term)
- develop effective strategies to 'close the achievement gap'
- deliver excellent lessons.

Steve Lomax, the mathematics lead for the GLOW Maths Hub said, "'We are excited to be chosen as the lead school for one of the first Maths Hubs, and we will work with schools and colleges to improve the pupils' enjoyment, achievement and participation in mathematics through support, research and innovation. The strategic partners are looking forward to breaking down traditional boundaries and working with new colleagues and mathematics communities from across the region to challenge perceptions, change attitudes towards mathematics and develop mathematicians for the future."

If you're in (or you think you are) the GLOW Maths Hub and would like to know more, do email Steve Lomax. A list of all the Hubs, and contact details for the lead school(s) of each can be found on the Maths Hubs pages of the NCETM site.

A resource for the classroom – a data handling murder investigation

The microsite What makes a good resource contains a wealth of treasures. It was created to give teachers an opportunity to present resources that have worked well for them, giving them the chance to explain exactly what they wanted from the resource and how this played out in their classroom. If you have not used the microsite before you might want to consider the concept of teaching negativity, placing numbers, or simultaneous biscuits to get you thinking.

For this month's featured resource, we have chosen the data handling murder investigation: you can see immediately that this has been well reviewed by a number of mathematics teachers who have used it in their classrooms. The individual parts of the investigation require pupils to complete an intelligence mystery, work on speed-time-distance, draw a height-weight scattergraph, calculate poison percentages, and work collaboratively as a group.

In keeping with this issue's From the editor, this resource may be another thing that you try fairly early in the new term to teach your pupils how you want them to be learning as well as the mathematical content. The teacher who originally presented the resource talks about the discussion that was generated amongst the pupils; if you believe that pupils learn by talking about their mathematics, then using this resource would be a way to encourage productive conversation as a positive feature of the mathematics lesson.

Do tell us how this went in your classroom and what you learned from using it.

5 things to do

As well as Mondrian in Margate (see Issue 112), you could also visit the Radical Geometry exhibition at the Royal Academy in London until 28 September. The exhibition brings together the work of South American artists in the 1930s who were inspired by artists that included Mondrian. On the exhibition webpage, you can watch an interview with the co-curator Adrian Locke or view the Gallery to whet your appetite. If you want to be both soothed and baffled, watch H J Freeland's Shepard/Penrose Mix-1 and Mix-2.

Although this is the Secondary Magazine, you may also like to take a look at the NCETM FE Magazine. You can view the Magazine Archive, or look at the latest issue, 36.

You could start to prepare for the MegaMenger, which takes place 20-26 October. Intrigue your pupils with mathematics of fractals by researching a Menger sponge. Pupils might find a Koch curve or a Sierpiński carpet easier to visualise.

You could use a quiet half hour relaxing in the garden, or reclining on the beach, or sheltering under an umbrella(!), to plan for a mathematics activity outside your classroom. What Royal Institute Maths Masterclasses are happening near you? Is an NRICH Hands-On Roadshow visiting your area, or could you host one at your school? Might some of your Y9 or Y10 pupils want to take part in an MMP research project?

Prepare your department meeting for September by using one of the NCETM Departmental Workshops. Why do we teach mathematics? or Learning mathematics in my school might be good for the start of a new school year.

And since it's summer, we hope you'll forgive a sixth item in our list of *5 Things To Do*, namely a nudge to read the interesting thoughts on the current changes to GCSEs and A levels, and what they mean for post-16 mathematics generally, in this recent report from the Nuffield Foundation

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Tales from the classroom: Business mathematics

So with summer here, Annie may well be safe in placing her bottom dollar on the sun coming up tomorrow. I suspect the more learned statisticians among you may not be quite so effusive with your dollars having studied the vagaries of recent British summers. However, as I discussed holiday plans with the business manager in my school, she suggested a dead cert wager: "The safest bet at this time of year is that some teachers that requested and were supplied with fans last summer will again request them this summer." She continued: "As far as I can remember, fans are not biodegradable so just where are they going? And before you ask, NO you can't have one!" I managed to chip in that I didn't actually want one, but this was not going to alter her stride. "And this happens every year."

I interjected "Sounds very much like my perennial 'When will we use this in real life Sir?'"

And thus an idea spawned. Sat in the office next to me, a valued, intelligent colleague is using mathematics every single day, and not one of my students knows it. It may not be of the Hadron Collider type, but it is real maths, used every day in a context that actually has relevance to my students, right now, not in the far future. So she agreed to share the maths she uses...

- Time for a refurbishment of the hall. So how high is that ceiling? Out comes the ruler, a squint of the eye with a vertical hold, turn it horizontal and ask your friendly accounts assistant to do her best sashay across to the end of the ruler whilst you hold that squint and a full seven metres of wall to climb is revealed. Negotiations with contractors begin with a sharp intake of breath. Talk of scaffold towers, health and safety regulations and tight deadlines ensues. With your Devolved Formula Capital you may have saved enough to complete the work for the price quoted by 2025, but then don't forget:, it's a refurbishment, will you be allowed to spend the DFC? If you halve department's capitation, add 45% to the minibus mileage charge and calculate how fast you need to sprint to stay one step ahead of the resulting angry mob behind you, the hall might just be refurbished using the school budget share – and during this summer too!
- Then there's the LA grant where you bid for £185k and are awarded £15k. Plans to extend the school kitchen are thrown out of the window, but equipment to prepare and cook an extra 200 meals per day still has to be purchased and installed within the six-week holiday. Floorspace is at a premium: measure twice and breathe in, then you might just squeeze in that the deluxe barista machine that's top of the essentials list.
- As the end of the holiday draws closer there is still the water leak to find. Shutting down the water in each block and then checking the volume usage chart for continuous flow reveals a suspect pipe. A bit of digging and a drip is found…but your stopwatch and measuring jug show the flow rate is too low to be the only drain on this vital resource. Maybe that storeroom in Maths 5 is not just your ordinary cluttered storeroom – fancy a dip in our hot tub and plunge pool anyone?
- You should never underestimate how much a teacher can cram into a store cupboard in an academic year. Will the live load per m^2 on the ROSLA block floor reach the ultimate point before the end of July? How much do 4000 text books, an old electric radiator, six disused fans, a stuffed duck, an old car engine and two packs of stale bourbon biscuits actually weigh? But then you mustn't forget a teacher's determination to clear out said store cupboard on the last day of term. The probability of running out of black bin liners gets lower each year as you have got used to seeing how quickly $50m^3$ of first floor lobby become a waste collection site. It's amazing how much those flimsy plastic bags can take before they decide to split and spill their contents, almost certainly within a cleaner's arm's length of the wheelie bins.

So as I prepare to answer another round of "When will we use this in real life Sir?" type questions, I have more facts in my head and some ideas for very practical projects that pupils can work on in the coming year. No complicated liaisons with external companies but by utilising resources in our own school.

The author is a mathematics subject leader and assistant principal working in the South West