



Welcome to Issue 84 of the Secondary Magazine.

School's out! How are you coping without bells and routines? As you recover mentally and physically from the last academic year, this issue may have some ideas to interest, provoke thought or merely entertain. Have a great holiday!

Contents

From the editor

Following the articles about research in Issue 83, this article considers the General Teaching Council (GTC) web page, [Research for teachers](#), as another source of interesting research.

It's in the News! It fell off the back of a lorry!

The [BBC reported](#) that over a million euros really did fall off the back of a lorry in Germany recently. This resource uses the news story as a context to explore estimation, weight and volume, exploring whether students would be able to lift this much money and whether it would fit in the back of a VW Golf.

The Interview – Hilary Povey

When you think of mathematics teaching, do you SMILE? Hilary Povey, Professor of Mathematics Education at Sheffield Hallam University talks about her involvement with SMILE and Cre8ate in this interview.

A resource for the classroom

Are you looking for a way to incorporate thinking and reasoning skills into your everyday teaching? This issue's resource is an Averages Mystery which aims to do just that. Why not have a look?

5 things to do

Suggestions in this issue include a mathematical tour of a world city, a chance to prepare for some new 'A' level teaching or plan a Maths Inspiration visit.

Tales from the classroom

How do you find out what your pupils know? This week's tale describes an interesting strategy used at the beginning of a lesson solving simultaneous equations.

From the editor – Teachers reading research

"I'd like to read some research but I don't know where to start." (A mathematics teacher.)

Do you feel like that? There must be research findings that have a direct application to our professional development which in turn impacts on the experiences of the pupils in our classes – but where to start?

The General Teaching Council (GTC) has a web page, [Research for teachers](#), as part of their Teacher Learning Academy (TLA). As the webpage says, it "provides high quality summaries of research findings and more detailed anthologies". The webpage also suggests that you may wish to read this if "you want to find out more about something of interest or you are planning a (TLA) project". The summaries have been selected and produced by the Centre for the Use of Research and Evidence Education (CUREE). Each summary starts with an overview section, which is a quick way to see if the summary really addresses things that interest you, and concludes with some suggestions for further reading.

It is possible to download the [full directory of summaries](#) or to use the filter to search by topic – unfortunately 'mathematics' is not a topic, so here are some suggestions of summaries that may interest you. Reading this article may tempt you to go and look at some of the summaries for yourself!

[Secondary school mathematics](#)

This summary starts by asking "Which aspects of mathematics teaching promote effective student learning and which tend to prevent it?" and summarises the study by Jo Boaler (author of *The Elephant in the Classroom*), 'Experiencing School Mathematics'. It talks about how different teaching characteristics affect boys and girls differently and how these different characteristics impact on student understanding. The study follows cohorts of students in two English secondary schools and reports on student understanding, ability to apply knowledge, confidence in mathematics-related situations and performance at GCSE.

[Promoting students' persistence in meeting challenges](#)

It could be argued that one of our biggest challenges in secondary mathematics is encouraging students to persevere when they encounter difficulties. I was drawn to the title of this research summary, hoping that it would shed some light on this area. Carol Dweck's 'Self-theories: Their role in motivation, personality and development' is the focus of this summary – it talks about students who have a fixed view of intelligence showing some 'self defeating behaviours' when they have a learning challenge, whereas students who have a 'growth mindset' believe that they can improve. The research shows that it is possible to change students' self-theory of intelligence and that doing so makes a difference to their achievement. If this issue strikes a chord with you, do go and read the summary for yourself.

What will you do now?

- you may feel inspired to read these summaries provided on the GTC website – and possibly access the studies themselves
- download the [full directory](#) and find other summaries to read
- the NCETM portal has a [Research Gateway](#) from which you can access more articles that may interest you using the filter on the site
- try one of the Research Study Modules on the NCETM [Accessing Research microsite](#).

Why not [share your experiences](#) and recommend other research papers that have had an impact on your practice?



It's in the News! It fell off the back of a lorry!

The [BBC reported](#) that more than one million euros really did fall off the back of a lorry in Germany recently! The safety deposit boxes were returned by the finder after a delay of a couple of days!

This resource uses this story as a context to explore estimation, weight and volume, whether students would be able to lift this much money and whether it would fit in the back of a VW Golf.

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 – Hilary Povey

About you

I am currently a [Professor of Mathematics Education](#) in the [Mathematics Education Centre](#) at Sheffield Hallam University where I am involved in educational research and in teaching mathematics. Much of my work relates to [social justice issues](#) in mathematics classrooms, and this has been a [continuous](#) thread through my professional life. Very early on in my teaching career I became a passionate advocate for [all-attainment teaching](#), and this remains true [today](#).

What inspired you?

I was lucky enough to start my teaching career with the Inner London Education Authority (ILEA). I began teaching in 1970 in an inner-city comprehensive in Hackney where the pupils were set for mathematics. I had recently emerged from training college where I had become familiar with the research that showed that the sorting of school students into bands and sets and streams has little effect on the attainment of a school's academically successful students – but it produces a long tail of poor achievement, and impacts very negatively on the social and personal welfare of those deemed unsuitable for the higher classes.

I also knew that students who come from less advantaged backgrounds are disproportionately found in the lower sets. At my school, for example, students who had recently arrived from the Caribbean (of whom there were many in the school) were to be found disproportionately in the lower band and lower sets and students with middle class backgrounds (of whom there were few) were clustered in the upper ones. So we asked ourselves: why on earth were we continuing these practices and wasn't it obvious that we were acting against social justice in doing so?

So what did you do?

I was young and idealistic (now I'm old and idealistic!) and was very concerned with these questions. I realised that the traditional model of teaching – teacher exposition followed by pupil practice – wasn't going to work in all-attainment classes. So when my head of department asked me to attend a week-long course the other side of London that was focusing on this issue, I grabbed the chance with both hands and with gratitude. Because of his vision and generosity, I was enormously privileged to be in on the birth of the [Secondary Mathematics Individualised Learning Experiment \(SMILE\)](#) curriculum development project. SMILE enabled me to work effectively in the all-attainment mathematics classroom.

What do you think good mathematics curriculum materials look like?

My earliest attempts at producing curriculum materials make me blush with embarrassment. My only mental model of a successful resource was one which a student was able to work through without needing to question me, their peers or (most especially!) themselves about anything – and which allowed them to get right some questions that they hadn't been able to get right before they started!

It now seems to me that almost all worthwhile mathematical activity requires us to struggle with problems which are difficult for us, problems that stop us in our tracks and need thinking and arguing about, perhaps just with ourselves but, for most of us most of the time, also with others. The students in my SMILE classes taught me these things – but I almost certainly wouldn't have been able to learn them if I hadn't had the regular, committed, even impassioned, involvement with other teachers trying their best to do the same job as me.

Tell us about working with other teachers

There were heads of department, some near retirement, through to young novice teachers like myself, and everything in between, all working together, sharing their expertise, their hopes and fears, their

problems and solutions, and developing wisdom. Decision-making rested with a consensus of those who participated and any and all were welcome and could contribute.

ILEA was willing to pump-prime projects and to support the energy and initiative of its teaching staff. It expected its teachers to be intelligent, creative and professional – and so we were able to be so. I gained hugely from working alongside a committed and mixed group of teachers, all of whom were eagerly and regularly examining their own practice, sharing anecdotes and reflections about the exciting things happening in their classrooms. The project showed that co-operation, mathematical excitement, mutuality and real learning are possible in mathematics classrooms in challenging schools.

Are you still involved in curriculum development?

I was recently one of the mathematics directors of the cre8ate maths project. The thinking behind it drew on those early SMILE experiences with teachers working with us to devise, try out, review and edit mathematics curriculum materials. The materials present doing mathematics as an open and creative activity with shared responsibility for structuring, problem posing and refining, decision-making and reporting. The pedagogy experienced is exactly the sort required to create those classrooms where pupils of all attainments can learn productively together even though most of the project teachers are a long way from sharing that as an ideal.

Why mathematics?

Mathematics is beautiful - and it's hard work.

Some beautiful mathematics you worked hard at recently is...

I find it much easier to think abstractly about mathematical objects than to visualise things. For example, I'm pretty hopeless at turning 3-D objects round in my mind. I recently sat for at least ten minutes staring at a beautiful model of a [snub cube](#) until I was sure I could see all its octahedral rotations! And we are currently arguing about the generalisability of [Liu Hui's](#) dissection to [find the volume](#) of the [frustum of a pyramid](#).

If you weren't doing this job you would...

...be walking in the hills!



A resource for the classroom – Averages Mystery

In a previous issue of the [Secondary Magazine](#), we talked about the fantastic [Durham Maths Mysteries](#). I've been thinking a lot about teaching for the new GCSE specification recently and these mysteries have played a part in my teaching. I'm always looking for ways that I can integrate a problem solving approach into my everyday teaching rather than using problems as 'bolt on' extras at the end of a module. Consequently, I was quite excited when a colleague recently gave me an averages mystery which is like the Durham Maths Mysteries.

The task is outlined on one of the [12 clue cards](#): 'Your task is to find the mean, median, mode and range for each group. When you've done that you might be able to work out what each individual scored in each group.' This looked as if it might be a good way to revise averages with my Year 9 group, so I tried it out.

In no group did everyone score the same amount. Group A came closest and has the smallest range.

Three groups of 5 people took a test. The test gave a score out of 5 for each person.

The lowest score in Group C was the same as the median score in Group A.

If all the scores in Group A are added together the total is 16.

How did it go? I decided that they would work in pairs so gave out the cards to each pair and waited for about five minutes before I did anything, then I stopped the class and asked them what they had to do. We also talked about the way that they were going to record their information and organise themselves – most pairs had drawn a variation of the table below. I was glad I hadn't given it to them first, as this was something they could do themselves to improve their skills.

	Mean	Mode	Median	Range	Scores
Group A					
Group B					
Group C					

This wasn't an easy task, but that increased the sense of pride that the pupils got from completing it and it did provide a useful way to revise averages which involved pupils in thinking, reasoning and justifying skills. Why not [tell us](#) how your pupils got on?



5 things to do

- [Summer School for teachers new to 'A' level Mathematics 22-26 August 2011](#)
If you are about to teach 'A' level Mathematics for the first time in September, have only been teaching 'A' level for a short while, or are planning to teach 'A' level in the future, then this free residential summer school will offer you the confidence, knowledge and resources to engage and support your 'A' level students.
- There is time to book a place on the three-day [STEM Teacher Inspiration programme](#) 2011/12. The programme is delivered by the NRICH team and will take place at the University of Cambridge on 30 September 2011, 19 March 2012 and 22 June 2012.
- Bookings are now being taken for the autumn 2011 series of [Maths Inspiration shows](#) in London, Birmingham, Manchester, Reading, Cambridge and Cardiff. You could arrange a trip for students in Years 10, 11 or 12.
- Have you been to a MathsJam weekend? The [next one](#) will take place on 12-13 November, at Wychwood Park, near Crewe. Alternatively, you could go to a monthly event in London, Manchester, Dublin, Glasgow, Edinburgh and Nottingham. Meetings are on the second to last Tuesday of every month, from 7pm in the evening - more information from the [MathsJam website](#).
- Marcus du Sautoy is creating [a website](#) to shine a mathematical spotlight on different locations by creating a virtual tour guide to cities around the world. You could visit some of these cities (virtually or in person!) or make a contribution to the site for your own city.



Tales from the classroom

This week we had a department meeting looking at Assessment for Learning (AfL) strategies. During the meeting we listened to [audio clip 2](#) from the Excellence in Mathematics Leadership resources (I'm sure it's Dylan Wiliam of *Black Box* fame speaking!).

I was really struck by the analogy he uses about pilots. He says that, if pilots flew the way that many teachers assess (he's talking about a flight he's taking to Glasgow), then they'd fly North for an hour or so, then land and say, "Is this Glasgow?" If the crew on the ground said no then the pilot would still say to the passengers, "Get off, I've got another job to go to." He draws parallels with this and the teacher who assesses at the end of a lesson or topic and asks if the class have learnt it. If they say "yes" then great, if they say "no" the teacher says, "Never mind, we'll do it next again term." While I think this is may be a little harsh, I certainly recognise the tendency he's illustrating. He repeats several times that assessment should be minute by minute and day by day and it has really put this at the front of my mind in all of my classes at the moment.

This week we've also started our new timetable, so I've been teaching new classes full of students that I don't know so well. AfL strategies have been proving really useful! I used the following activity at the beginning of a lesson revisiting simultaneous equations with my new Year 11 class. Their old teacher had said that they were ok at it but needed a little more practice. This gave me a very instant snapshot of where they were at...

Write down three consecutive terms of an arithmetic sequence – go on, do it!

Now write down three terms of a different arithmetic sequence.

Use these terms as the numbers in a pair of simultaneous equations so, for example, if the terms you chose were 15, 18 and 21 you've got the equation $15x + 18y = 21$.

Now, before you read the next line, solve your pair of equations for x and y .

I bet you got -1 and 2 didn't you?!

The ripple of amazement that went round the class when they realised that everyone had reached the same answer from different starting points was lovely, and the look on the faces of the couple of students that didn't get the same answers let me know who I needed to work with that lesson!

The resource is one of the RISPS from risps.co.uk, which is mainly aimed at 'A' level but has some great ideas that could be poached for lower down the school too.