



Welcome to Issue 99 of the Secondary Magazine (incorporating FE)

The exam season is over! All your hard work, and that of your pupils, will soon be rewarded. In the meantime, there is a chance to change routine, re-find your mathematical creativity and enjoy this issue of the Secondary and FE Magazine.

Contents

From the editor

Does your departmental improvement plan include a success criteria related to improving the quality of teaching? What do the actions on your plan look like? Here are some thoughts to improve the quality of teaching in your classroom and your department.

A resource for the classroom – multiplicative reasoning

The high quality resources focusing on what's called multiplicative reasoning developed by the [ICCAMS project](#) are featured in this issue. Might this be the time of year for your pupils to gain a greater understanding of multiplicative reasoning?

Focus on...research

The latest informal proceedings from the maths research body, the British Society for Research into Learning Mathematics (BSRLM), are highlighted, alongside other avenues to explore in considering research.

5 things to do

Planet Earth, Key Stage 4 Enrichment, 21st Century fellowships, a free assisted drawing tool and an NRICH hot air balloon game could be on your 'to do' list after reading this issue.

Tales from the classroom

As it is summer, experiences outside the classroom feature in this *Tale* – and when do you butter toast?

Image credits

Page header – [A Snapshot of Sea Ice](#) by [NASA Goddard Photo and Video](#), some rights reserved

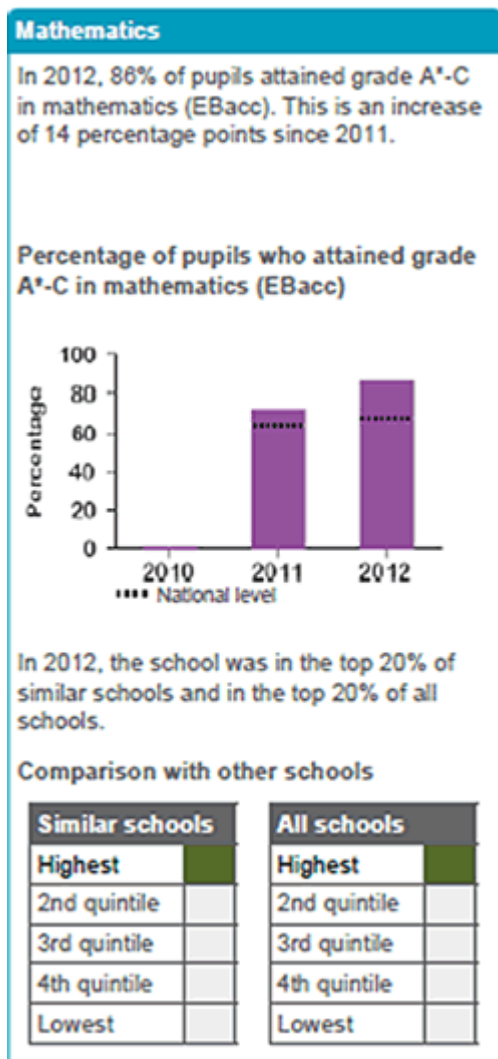


From the editor: Data Dashboard

You may have already seen the [Ofsted Data Dashboard](#). As the website says:

The School Data Dashboard provides a snapshot of school performance at Key Stages 1, 2 and 4. The dashboard can be used by school governors and by members of the public to check the performance of the school in which they are interested.

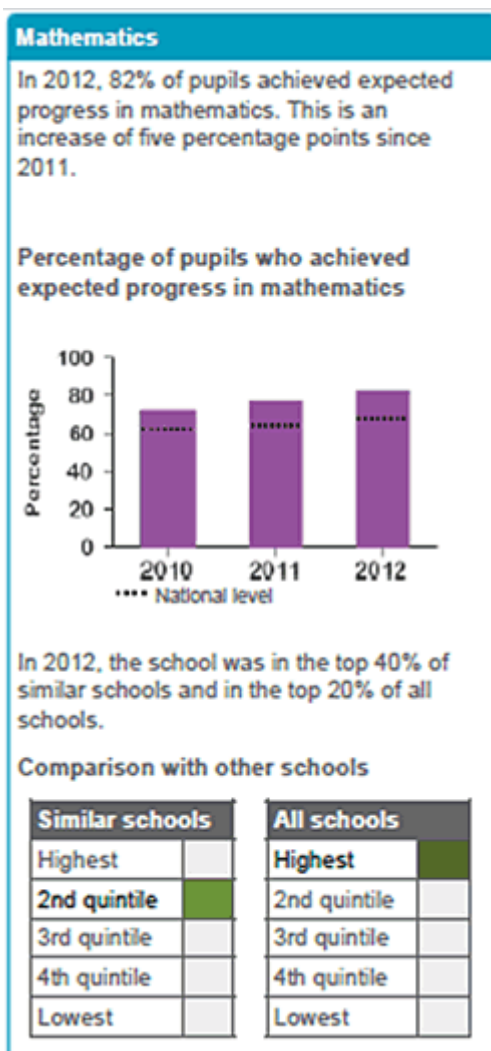
If you haven't seen this yet – go to the website and find the Data Dashboard for your school. It is easier to download the PDF file if you want to print this off. There are several parts of this dashboard that feature mathematics directly. As mathematicians, we know that data scrutiny can identify issues to investigate. Having completed our investigations, it is good to celebrate successes and share issues to work on. This document is available to anyone who has access to the internet; parents, carers, governors may have a particular interest in considering this data for your school. What questions might they ask about mathematics? How will you respond?



(the tables at the bottom comparing this school with similar schools consider the performance of pupils at this school with pupils at other schools that have similar prior attainment)

Here are some potential questions to consider:

- it could be possible for pupils to perform well compared to similar schools yet still be placed in a lower quintile against 'all schools'; do you need to have a way of explaining that?
- the bars on the graph for your school may show a rising trend that is below the national trend lines – what will you say?
- you may have a declining trend, how will you explain that?

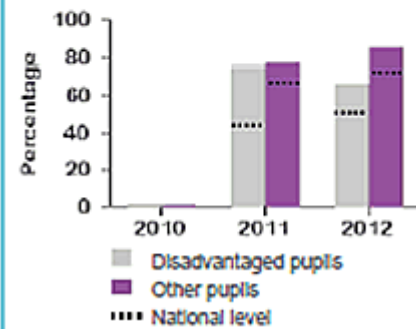


- why don't all pupils make expected progress?
- which pupils don't make expected progress?
- how does your department help all pupils to make expected progress?
- what percentage of pupils make more than expected progress?
- what is expected progress in mathematics?

Mathematics Expected Progress

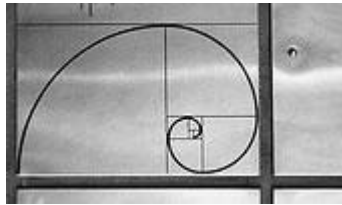
In 2012, 66% of disadvantaged pupils achieved expected progress, while 85% of other pupils achieved expected progress.

Percentage of pupils who achieved expected progress



- why is the progress made by disadvantaged pupils different from the progress made by other pupils?
- is the gap between disadvantaged students and their peers bigger or smaller than the national gap at your school?
- what extra help do you give to disadvantaged pupils to accelerate their progress?

The Ofsted Data Dashboard could be a useful focus for discussion in a departmental meeting so that you have a common understanding of possible public perceptions of mathematics in your school suggested by the data, and how you will tackle the resulting issues.

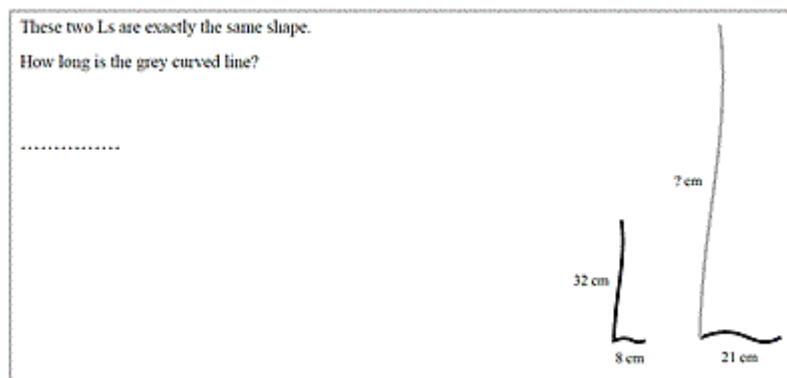


A resource for the classroom – multiplicative reasoning

The [ICCAMS \(Increasing Confidence and Competence in Algebra and Manipulative Structures\)](#) project was a four-year research programme based at King's College, London. It ran from 2008 to 2012 and investigated ways of raising student attainment and engagement by using formative assessment to inform teaching and learning of mathematics in secondary school. On this page we highlight the resources attached to the [Multiplicative Reasoning](#) section of the project.

Teachers are invited to [email Dietmar Küchemann](#) at King's College, to have access to ten pairs of lessons, each with a starter activity but a sample of a pair of lessons and starter can be accessed immediately from the website.

The [starter task](#) is intended to be used some time before teaching the pair of lessons: pupils are invited to complete a Mini Ratio test so that the teacher can gather the range of methods that are used by the students.



[Lesson 2A](#) focusses on multiplication in terms of scaling and uses the context of a map of a residential area (Westgate Close)

[Lesson 2B](#) uses the same context (Westgate Close) to work with a double number line as a way of converting between feet and metres. This is then extended to include a mapping diagram and a Cartesian graph.

What could you do next?

- [email Dietmar Küchemann](#) to get the other lessons
- do some starters that focus on manipulating numbers with pupils before tackling the other lessons so that they are better equipped to develop their conceptual understanding rather than wrestling with the mechanics of the situation
- look at the scheme of work and see where these lessons would sit
- share them with colleagues
- think about the images you use with pupils when talking about scaling and multiplicative reasoning: the idea of stretching an elastic band might be useful.

Suggested further reading: the NCETM Departmental Workshop, [Proportional reasoning](#).

Image credit

Page header: [Golden Ratio](#) by [ErnestDuffoo](#), some rights reserved



Focus on...research

The [British Society for Research into Learning Mathematics \(BSRLM\)](#) website states:

BSRLM is for people interested in research in mathematics education and provides a supportive environment for both new and experienced researchers to develop their ideas.

BSRLM holds three one-day conferences a year which give researchers an opportunity to present their current research. You can view [The Proceedings of the Day Conference held at the University of Bristol on 02 Mar 2013](#).

Ten topics were covered at the March conference, and to give you a flavour, we mention two here.

1. [The use of Bloom's taxonomy in advanced mathematics questions](#) by Ellie Darlington:

Group A	<i>Routine procedures</i>	
	Factual Knowledge and Fact Systems	Recall previously learnt information in the form that it was given.
	Comprehension	Decide whether conditions of a simple definition are satisfied, understand the significance of symbols in a formula and substitute into that, recognise examples and counterexamples.
	Routine Use of Procedures	Use a procedure/algorithm in a familiar context. When performed properly, everyone solves the problem correctly, in the same way. Students were previously exposed to these in drill exercises.
Group B	<i>Using existing mathematical knowledge in new ways</i>	
	Information Transfer	Transfer information from verbal to numerical or vice versa, decide whether conditions of a conceptual definition are satisfied, recognise applicability of a generic formula in particular contexts, summarise in non-technical terms, frame a mathematical argument from a verbal outline, explain relationships between component parts, explain processes, reassemble given components of an argument in their logical order.
	Application in New Situations	Choose and apply suitable methods/information in new situations.
Group C	<i>Application of conceptual knowledge to construct mathematical arguments</i>	
	Justifying and Interpreting	Prove a theorem in order to justify a result/method/model, find errors in reasoning, recognise limitations in a model, ascertain appropriateness of a model, discuss significance of given examples, recognise unstated assumptions.
	Implications, Conjectures and Comparisons	Given or having found a result/situation, draw implications and make conjectures, and justify/prove these. The student can make comparisons, with justification, in various mathematical contexts.
	Evaluation	Judge the value of material for a given purpose based on defined criteria which may be provided or need to be determined.

Table 1 – Categories in the MATH (adapted from Smith *et al.* 1996)

2. [Professional development for problem solving: a dialogue with one teacher](#) by Miroslava Sovičová and Marie Joubert. Here you can read about one teacher's learning journey as he uses two 'familiar' tasks (*Counting Trees* and *Gold Rush* from the [Mathematics Assessment Project](#)) to develop problem solving with his pupils.

What will you do now?

- read this paper or another from the latest proceedings of BSRLM?

- if you are interested in research into mathematics education, you could look at the [NCETM Research Study Modules](#). Any one of these would provide a good focus for a departmental CPD session
- the NCETM website also hosts a [Research Gateway](#) which allows you to search for mathematics related research papers
- previous NCETM Secondary Magazines have also featured research. Have a look at [Issue 85](#) that carries an article about BSRLM.

Image credits

Page header - [Non-linear Bloom's Taxonomy](#) by [David Wees](#), [some rights reserved](#)



5 things to do



Explore the website for [The Mathematics of Planet Earth 2013](#). This includes some [posters](#) to print out and some curriculum materials. The module on [exploring climate change by graphing functions](#) links to a [NASA Climate change module](#).



The Further Mathematics Support Programme is running a programme of two one-day [Key Stage 4 Enrichment and Extension CPD courses](#). This programme will be run at a series of venues across the country, funded by the DfE and is offered free of charge to state-funded schools, colleges and academies. In addition, participants' schools will be eligible to claim £400 per teacher to enable attendance. A maximum of two teachers per school can claim funding, and booking for these courses is now open. Some sample resources available are the [Indices and Roots Maze](#), and [Quadratic functions and expressions](#).



Apply for a Fellowship with [The 21st Century Learning Alliance](#) to help teachers turn 'great ideas' into action research projects with the aim of developing and sharing best practice.



Consider whether the free [Assisted dRawing toOI \(ARO\)](#) would benefit any of your pupils? The Tool has been developed to assist physically disabled or injured students who cannot create mathematical drawings on paper. It is intended to make mathematics up to Key Stage 4 more accessible.



The latest feature on the amazing [NRICH website](#) is a set of tasks working with directed numbers. Included is the game [Up, Down, Flying Around](#) which uses the images of hot-air balloons, hot air and sand bags to work with directed numbers – and has a video tutorial to explain the game.

Image credits

Page header - [Ballooning in the Sun](#) by [thebadastronomer](#), [some rights reserved](#)



Tales from the classroom: a mathematical residential

This *Tale* is really a tale from outside the classroom. I am a passionate advocate of the value of residential experiences so it seemed natural to try to arrange a Year 7 residential mathematics weekend which has now run for several years. The first time this weekend was offered, it seemed like a lot of work - 48 hours of mathematics related activity - how would that work?

It was decided that this was an opportunity to develop problem solving skills with lots of collaboration rather than learning any 'hard' mathematics so there was a focus on creating memorable experiences throughout the weekend.

The local church provided the focus for much of the first day: with some help from a humanities teacher, pupils were able to explore some of the gravestones looking at the language used and the dates. They were quickly on a search for the person that lived the longest – and the shortest; we all had to visit the grave of a baby that died after two days. An amazing angel headstone and a Celtic cross also commanded interest. All my concerns about potential lack of respect were completely unfounded as pupils gathered data from the gravestones to start investigating a hypothesis... and in the end we did include some moving averages in the graphical representations – it just seemed natural!

The stained-glass windows in the church gave an opportunity to talk about tessellations, investigate angles, draw on squared paper and create a massive tessellation picture to take back to school.

Other activities included paper folding, experimenting with a [harmonograph](#), a mathematical treasure hunt, some quiz events and a very exhausting game of rounders.

It might seem hard to quantify the value of an event like this. For that group of pupils it was certainly a memorable weekend; they loved the mathematical element and the challenges posed; they worked with several different members of the mathematics department rather than their own teacher; they worked with different pupils; their mathematical and social confidence increased markedly during the weekend. I'm getting lots more smiles and greetings in the corridor! I hope this positive experience of mathematics will stay with this group of pupils but also impact on other pupils that they work with. It has certainly changed the dynamics amongst the staff that were there.

One of the most memorable incidents of the weekend wasn't mathematical at all. One of our able Year 7 pupils was about to make himself a piece of toast for breakfast. I watched him take a slice of bread out of the bag and stand holding it for a moment. 'Do I put the butter on it before I toast it?' he asked.

If you feel inspired to run a residential weekend or a day event, do tell us about it.

This issue's Tales from the Classroom was written by a mathematics teacher working in the West of England.