



Welcome to the fourth edition of this bimonthly magazine for post-16 mathematics and numeracy educators. Previous issues, which you can access via the [archive](#), have been well received and we hope you will find the final edition for this academic year of interest too.

If you have comments, suggestions or articles for possible inclusion in future editions, please [contact us](#).

Contents

[The mathematics I do on a daily basis](#)

A website designer and photographer tells us why he needs mathematics.

[Taking numeracy forward](#)

Regional Maths Week in the East of England.

[Focus on...Action Research Projects](#)

An update on this year's projects.

[Mathematics and numeracy](#)

The importance of 'having a go' in mathematics.

[Misconceptions and mathematical misunderstanding](#)

Teaching, tests and targets – their effect on classroom practice.

[Ideas for the classroom](#)

Using plenaries effectively.

[Have you seen...?](#)

Resources of interest to teacher trainers and trainee teachers.

[And finally...](#)

Some great new materials under development which will be posted on the Excellence Gateway in the near future.

The mathematics I do on a daily basis



A website designer and photographer tells us why he needs mathematics

Why do I need mathematics?

It must be great to work on the internet all day, building websites, creating new ideas, designing graphics, working with cool photos... and, oh yes... surfing the web all day!

That's the response I generally receive from youngsters who find out what I do for a living, and it is why we always have a queue of eager students wanting to do their work experience with us!

One thing they often do not realise is the role that mathematics plays within our work: Maths...? Why do you need maths to build a website? Well, it's needed to work out various aspects of website construction, from the overall dimensions of a site in pixels to calculating the spacing of images, text and graphics, often in percentages of the site dimensions as a whole. Sure, modern website-building software helps with these calculations - but then, like a pocket calculator, it is only useful in the hands of someone who knows its capabilities and how to use it.

I am fortunate as I effectively have two jobs in one, both of which I enjoy immensely. Half of my time is spent building websites and the rest of the time I am a photographer. "Cool!" say the kids. "Do you get to photograph celebrities?!" Well... in a word, no! I mostly get to photograph company buildings, people at work and coffins - yes, I do mean real coffins! Mind you, I do get to photograph the odd MP every now and then. But I doubt they fall into the realm of 'celebrity'!

Even as a photographer though, maths is still very important. Just a couple of examples would be, for instance, calculating lens crop factors and working out size ratios of prints. To explain: a digital DX SLR sensor is smaller than 35mm film - in the case of my camera it's actually 1.5 times smaller. This means that a 27-300mm lens would actually be an 18-200mm lens when attached to my camera! Then, after calculating that, when you print your photo you need to understand resolution: for example a print at 150dpi (dots per inch) can be twice as large as your original 300dpi image but will only have half the resolution.

Now, I must admit that at school, mathematics was not my favourite subject by any stretch of the imagination. The very thought of fractions, equations and mental arithmetic made me cringe! Looking back, the biggest reason I can think of as to why I disliked it so much was that it never seemed relevant. There never seemed to be any relevance as to why we were learning a particular type of maths and to this day I can still remember being sent out of the class for cheekily saying to the tutor, "Sir, why have we got to learn fractions? We went decimal in 1971!?!?"

But I am glad I persevered, as the job I do now would be much tougher, if not impossible without some maths knowledge. I soon understood that to get ahead in life you must have a good knowledge of mathematics...it's not just for bankers and accountants!

Is there someone you know who would be willing to be interviewed for this regular column? [Email](#) your suggestions to us.

Taking numeracy forward



The East of England is unique in having a [Regional Maths Centre](#), managed by the Association of Colleges in the East of England (ACER). The Centre aims to:

- develop an infrastructure of experienced mathematics/numeracy teacher trainers able to offer advice, support and training to providers in the East of England
- provide direct support to practitioners to help them improve their own professional practice
- create a network for practitioners to exchange ideas and information around any issue/activity to do with the teaching and learning of maths and numeracy
- develop links with business in the East of England to help identify the workplace need and demands for maths and numeracy skills.

In support of these aims, a Regional Maths Week was held in conjunction with Adult Learners Week to encourage the public to learn some more mathematics and practitioners to further their professional development or to begin to teach the subject.

We hope that the following account may encourage you to try out some of these ideas where you work.

The following offer was made to providers: "If you host a Maths Week event, you can keep half the places for your staff and ACER will advertise the other half externally." This allowed providers to access top-quality maths CPD delivered by an experienced team, in return for the use of a room. Fifteen providers took up this offer, hosting events attended by a total of 120 practitioners.

Some of the events held were:

- **Essex County Council ACL, County Hall, Chelmsford** – giant maths floor puzzles, sample maths activities, opportunities to speak to advisers
- **National Construction College, Norfolk** – a unique event focused on maths in the workplace
- **Army Education** – this engaged specialist and vocational tutors in the embedding of numeracy/maths into everyday teaching



- **Literacy, Language, ESOL and Maths** – this demonstrated how maths can be embedded into other Skills for Life sessions

- **Financial Literacy and Maths** – this offered practitioners possible classroom-based approaches to budgeting and finance in these credit-crunch times
- **You do the Maths** – held at several venues, this session energised and reinvigorated maths/numeracy teaching using new ideas and resources such as Top Trumps for statistics, and active maths with string and elastic for angles, shape and multiplication.

Every delegate who attended an event received a goody bag full of resources, information leaflets and booklets from donors such as BBC Raw Numeracy, NIACE, Move On and LSIS, as well as a unique [tea-towel](#) showing various methods of multiplication.

Regional Maths Week CPD Champion Award



This was awarded to a practitioner who had made a real impact with colleagues or with learners in the classroom as a result of CPD they had undertaken. The winner was Jan Rodwell, of Essex ACL, who beat off strong competition to receive a new laptop and a certificate at the Adult Learners' Week award ceremony. Jan is a regular attendee at the Essex Maths Cluster, one of the regional practitioner networks set up by ACER.

The Impact of Regional Maths Week

Comments were highly complimentary. People had been enthused and took away new ideas and approaches to try out. There has been an increase of interest in future ACER CPD events as well in qualifications such as the L5 Diploma.

At the public events, Essex ACL had asked people to consider teaching maths/numeracy and Regional Maths Week had gone some way to provide a means of finding new staff. Advice was given and learners encouraged back into the maths classroom.

We'd be interested to hear of any local initiatives where you work. Please [email us](#).

Further reading

[Taking the Numeracy Challenge Forward, Numeracy Case Studies](#)

Focus on...Action Research Projects



What a difference a year makes – Action research projects supported by the LSIS Excellence and Improvement Fund

Building on work carried out by last year's project holders, this year's Action Research Projects have got off to a good start. These projects are part of the drive to encourage and support practitioners in the further education sector to conduct their own teaching and learning enquiry by identifying an issue, exploring possible solutions and measuring the impact on teaching and learning.

Across the STEM subjects, more than 75 projects have been accepted and are well under way. Practitioners from all parts of the sector are involved in investigations focusing on issues that will make improvements to teaching and learning. Some are working in collaboration with colleagues across STEM departments or taking a whole organisation approach. Others are working in consortia with other providers.

Some of the emerging themes from this year's projects:

- **Supporting colleagues to examine and reflect on ways to improve their practice**
Tyne Met College's engineering department is encouraging staff to make a clear shift away from more traditional delivery techniques in core subjects such as mathematics and to engage in more active learning strategies using a variety of teaching and learning approaches. They are setting up teaching squares to observe, give feedback and measure the impact on their learners.
- **STEM colleagues working collaboratively to improve teaching and learning across science, engineering and mathematics**
An example of this is at Wirral Met College, where the mathematics subject learning coach (SLC) is working closely with her engineering colleagues to improve the delivery of mathematics in engineering. She is introducing a range of approaches and resources used in mathematics to engineering practitioners, in order to build confidence, offer support and improve practice.
- **Working together to improve the quality and consistency of teaching and learning**
At Exeter College, the aim of the project is to improve the learning in practical sessions, to share practice across six science departments, and to agree on the underlying principles for maximising learning in practical sessions. Measuring the impact on learning, top tips and "how to get the best from your practicals" are the expected outcomes of the project.

Getting Started events in January provided opportunities for researchers to get to know the projects, to share ideas, and to get support on action planning and examining ways of measuring the impact of their projects.

The feedback from delegates at the Getting Started Networks was very positive:

"The opportunity to talk to like-minded people was really helpful to plan out my objectives."

"The opportunity to hear how other people are approaching their projects, time to think, discuss, and start action planning was very useful."



FE  work-based learning  adult numeracy  offender learning

Regional dissemination events are planned for late September and early October 2009 with the final case studies and accompanying resources and materials available on-line at the end of September on the [Excellence Gateway](#).

Some of the completed projects will be showcased at the [LSIS](#) National Teaching and Learning event on 2 July 2009.

Mathematics and numeracy...but I don't know where to start



Being functional mathematically doesn't just mean being able to work out your gas bill or check your change in the shop, valuable though these skills are. It means a willingness to try things out. There is something about mathematics problems that often provokes one of two responses from our learners:

- 1 I can do this because I can see what it is I need to do.
- 2 I can't do this because I don't know where to start.

And the mathematics student's intuitive sense of inverse proportionality, summed up in the phrase "the shorter the question is, the harder it is to solve" is a reflection of the second of these.

Show that $\sqrt{2}$ is irrational.

Why do some polygons tessellate and others don't?

What's the best mobile phone package for me?

As maths teachers we need to teach our learners to accept a third option:

- 3 I can't see exactly what I need to do, but I am going to try some things anyway.

Option 3 is what real mathematicians do. Did [Andrew Wiles](#) know all the steps of his proof for Fermat's Last Theorem when he started out? Do you know the financial benefits of different phone packages without research?

Inside the classroom, mathematics can sometimes seem to be a trick played on learners – the teacher knows how to do it and the learners have to guess what's in their mind. Showing that $\sqrt{2}$ is irrational is easy, once you know that way to do it is to assume the opposite is true. Maybe the first person to figure it out immediately realised that proof by contradiction was going to bear fruit, but I doubt it.

Let's take the question "**Why do some polygons tessellate and others don't?**"

Where to start? What does tessellate mean? What is a polygon? Can I draw some? Can I make some? Can I make tentative conjectures? Am I going to be mortified if my initial conjectures are false? What if I don't find the answer – is all my work wasted?

Part of the anxiety that many people feel when given a maths problem is that there is no middle ground. You either get it right or you get it wrong. If you get it wrong then your work is wasted and you can define yourself as "useless" at maths.

Perhaps we can encourage our learners to honour the middle ground. You might not find out why some polygons do tessellate but you might be able to say why some don't. Or you might find sets of polygons that tessellate but are not sure whether you've missed any. To teach our learners to be mathematically functional we have to help them develop the courage to go up blind alleys, to try things out no matter how trivial they may seem, to accept that making mistakes is how we learn not to make them in the future and (Andrew Wiles is a case in point) that we seldom get things right first time.

Misconceptions and mathematical misunderstanding



Teaching, Tests and Targets

What, you may ask, have tests and targets to do with mathematical misconceptions and misunderstandings? The answer is “quite a lot” as, unfortunately, it is possible for learners to pass tests with their mathematical misconceptions unchallenged.

The current culture of testing learners frequently, and assessing the effectiveness of their teachers equally often, is affecting the way teachers teach. In the *Times Educational Supplement* of 22 May 2009 there were at least eight references to the unwanted side effects that testing is having on learners of all ages in English, mathematics and science. For example:

“The bulk of graduates are less prepared for university than they were before mandatory testing.”
Nathan Greenfield, concerning Canada.

“Year 6 pupils in particular were too often involved in practising responses to national test questions rather than engaging in exciting science work.” Ofsted *Success in Science* report, 2008.

“Since SATs ended my daughter says she is now doing fun maths. Shouldn’t all maths be fun when you are 11?” Comment on KS2 SATS from a parent.

It is understandable that teachers’ natural response to tests and targets is to prepare their learners to pass tests, rather than to be able to use their mathematical knowledge in daily life. For example, learners may know how to multiply two numbers together, but they have no idea when it is appropriate to do this in order to solve a mathematical problem.

It seems we have a culture which favours rote learning and success in the short term, rather than fostering deeper learning that will stay with the learner for life.

What can teachers do about this? They are unlikely to be able to change the testing culture overnight, but they can teach in a way that ensures that concepts are understood and not just memorised. The argument is often heard that there is no time to teach in this way. Please try it, because there is! In the long term, it is a better use of time to teach in this way because learners engage with topics in depth and learn for life, rather than “doing” a topic one week and forgetting it the next.

There are many resources available to support teaching in ways that promote understanding. Two of these are:

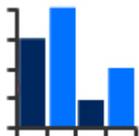
[Improving Learning in Mathematics](#)
[Thinking Through Mathematics](#)

Note: *Thinking Through Mathematics* is no longer available in hard copy, but an online version is expected soon. In the meantime why not try to borrow a copy from a colleague?

Further reading

[Improving Learning in Mathematics: challenges and strategies](#), Malcolm Swan

Ideas for the classroom – Using plenaries effectively



For some time, our colleagues in the schools sector have been encouraged to structure their lessons around a starter activity, a main activity and a plenary. Like the recommended essay structure of an introduction, main text and conclusion, this idea has much to recommend it.

Starting a lesson is usually easy. All learners are notionally starting from the same place and the rationale for the lesson can be explained.

Beginning the main part of a lesson is easy too, if the lesson is thoroughly planned and resources are prepared and to hand. A conscious effort is made to address the needs of all learners through the use of open questions, rich tasks and differentiated materials, and learners can engage with these at their own pace.

And so you come to the plenary. What is it for? Here are some possibilities, in no particular order:

- To provide a full stop at the end of a lesson, particularly if the main activity has taken longer than planned.
- To assess whether learning objectives have been met.
- To assess what has been learnt during the current lesson (not always the same as the previous item).
- To discuss issues that have arisen during the lesson.
- A time for reflection on what has taken place in the lesson.
- An opportunity to pose challenging questions for learners to think about between lessons.
- Formative assessment in preparation for the next lesson, so that the next lesson builds on what learners know already.

Many of us attempt to assess learning by asking learners to answer written questions which must be marked, and this can take valuable teacher time. Learners often pay more attention to the mark than to the errors that have been pointed out to them, so they learn little from this process (see Further reading no. 3). Why not consider asking learners to mark each other's work using a mark scheme?

Here are some other activities you might use during a plenary:

- Mini whiteboards. If you haven't yet used these yet you have a treat in store. Questions can be asked of learners and the results displayed for the teacher to see. This provides instant feedback, and the opportunity to amend subsequent questions in the light of the answers given. Sometimes it appears that the teacher has taught but the learners have failed to learn, and it is important to find this out.
- Traffic lights. Ask learners to self assess their learning according to how confident they feel about the lesson content. (Take care. How do you know that they are answering honestly? It takes a brave soul to confess ineptitude publicly).
- Ask a learner or group of learners to summarise what they have learnt in the lesson.
- Ask groups of learners to prepare a poster summarising the lesson content.
- Ask learners to prepare an account of the lesson for an absent classmate.
- Ask the learners to prepare a question on the taught topic, and a specimen answer. Collect the questions together and use them for a class homework or a test.
- Ask the learners to stand up. Offer a rich mathematical situation and ask each learner to make individual observations about it. Less able learners should be encouraged to go first so that

simpler observations may be made, leaving the more able the challenge of finding a unique observation towards the end of the plenary. Try it out with this [bar chart](#).

Further reading

1. [Examples of starters and plenaries](#). Mainly for primary age learners but many ideas could be adapted
2. [Asking Mathematical Questions Mathematically](#)
3. Professor Dylan William on [types of assessment that promote learning](#)
4. Some suggestions for [using mini whiteboards](#).

Have you seen...?



Mathematics Resources for Further Education Teachers in Training

A set of two CD-ROMs which aims to help you:

- pass your training and thereafter maintain QTLS
- teach FE mathematics with increasing confidence
- become aware of the professional development opportunities at the National Centre for Excellence in the Teaching of Mathematics (NCETM)
- consider the advantages of joining one of the three mathematics subject associations
- save time when looking for certain secondary and FE mathematics materials including those from the QIA Excellence Gateway, National Strategies: Secondary, QCA, DBIS etc.

They also provide links to useful mathematics websites as well as copies of other important resources.

If you are an FE teacher in training, ask your course tutor for a copy of the CDs.

Course tutors can get multiple copies by emailing joan.ashley@ncetm.org.uk.

[TALENT – training adult literacy, ESOL and numeracy teachers](#)

A website with information and advice for teachers, teacher trainers and those interested in becoming teachers in the adult sector.

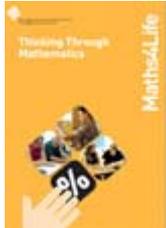
[BoardDeskHead](#) is a [Mathemapedia](#) article on using interactive whiteboards effectively.

[Gold dust](#)

A set of resources to support the generic skills, knowledge and understanding of trainee teachers. Organisations will also find the resources useful when planning their own continuing professional development (CPD) programmes. Subject learning coaches will find these resources particularly useful in supporting colleagues with their teaching and learning.

We would be pleased to include your recommendations for this section of the magazine. Please [email](#) them to us.

And finally...



Some great new materials under development, which will be posted on the Excellence Gateway and the NCETM portal in the near future:

- **Numeracy nuggets and mini modules**
A selection of short sessions for teaching and learning on a variety of mathematics topics. They will also contain ideas for professional development that you can squeeze into a department meeting.
- **Thinking Through Mathematics online**
The bad news is that the yellow folder is no longer available to order. The good news is that it is being replaced as an online tool. There will be online professional development sessions and a reflective diary that you can use as evidence of your CPD. You will also find your favourite TTM teaching materials available to download.
- **Managers Talking STEM**
A new tool to get senior managers thinking about progression routes through STEM and developing strategies for strengthening those routes.
- **Practitioner-generated resources**
Over the years, subject learning coaches in mathematics have been developing their own resources and sharing them in their network meetings. Now these resources are being made available to everyone.