Primary
& Early Years
Magazine 78

National Centre
for Excellence in the
Teaching of Mathematics

Welcome to another issue of our Primary Magazine. This magazine has been serving primary teachers for 77 issues with a varied collection of articles related to maths education and mathematics professional development - all of which are accessible through the Primary Magazine Archive.

We are taking a break from our usual structure for this edition to provide you with a slightly more relaxed focus on primary maths as you enjoy your summer holidays.

In this issue we have five sections:

- News
- New National Curriculum in Focus - Assessment Materials
- Mathematical Holiday Entertainment
- Reflections from teachers on the mathematics academic year just ended, and
- Planning your Mathematics CPD?

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News

New assessment materials

The NCETM, working with teachers through the Maths Hubs programme, has published new materials to help primary teachers assess pupils' mastery of the mathematics curriculum. See this issue's New National Curriculum in Focus for an article explaining the materials in more depth. They are the latest addition to the NCETM's comprehensive set of online resources to help teachers develop their teaching in line with the new curriculum.

New Ofsted inspection framework

Ofsted has published its new Common Framework for Inspection Handbook that will come into effect from September 2015.

Paragraph 157 is specific to the teaching of mathematics and there is evidence of shift in expectations towards the teaching for mastery in mathematics. For the first time in this guidance for inspecting mathematics the term 'master' is used and other guidance points to a mastery approach such as depth in favour or acceleration. Below is the guidance for inspectors with regards to inspecting maths in schools. The italics are ours.

157. When evaluating the effectiveness of a school's work in mathematics through the analysis of performance information/published data, observations in lessons and scrutiny of pupils' work, inspectors **will** consider:

- *how well the school is identifying and tackling inconsistency in the quality of mathematics teaching between different groups of pupils*, key stages, sets and classes, including those taught by non-specialist teachers of mathematics in secondary schools

in the mathematics lessons observed, through discussions with pupils and scrutiny of their work and by reviewing curriculum plans, how well teaching:

- fosters mathematical understanding of new concepts and methods, including teachers' explanations and the way they require pupils to think and reason mathematically for themselves
- ensures that pupils acquire mathematical knowledge appropriate to their age and starting points and enables them to recall it rapidly and apply it fluently and accurately, including when calculating efficiently and in applying arithmetic algorithms
- *uses resources and approaches to enable pupils in the class to understand and master the mathematics they are learning*
- develops depth of understanding and readiness for the next stage – the national curriculum for mathematics at Key Stages 1 and 2 specifies the aims and then states, 'The expectation is that the majority of pupils will move through the programmes of study at the same pace'. At all key stages, the national curriculum states, 'Decisions about when to progress should always be based on the security of pupils' understanding and their readiness to progress to the next stage. Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice,

before moving on'
- enables pupils to solve a variety of mathematical problems, applying the mathematical knowledge and skills they have been taught
- enables pupils to apply their mathematical knowledge and skills in other subjects in the curriculum, where appropriate.

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Two new Maths Hub lead schools sought

The NCETM is conducting a selection process to appoint new lead schools for two Maths Hubs: the one currently serving the south-east of London, and a new one serving north Lancashire and Cumbria. Both primary and secondary schools are eligible to put themselves forward.

New writer/editor for this magazine

We are seeking new writers and a new writer/editor for this magazine. The original deadline for applications was 31 July, but, given the summer pause, we are able to extend the deadline until **noon on 10 August**. Details of how to apply are on our recruitment page.

Mathematics CPD and networking events

Don't forget to use our Professional Development Calendar if you are looking for courses or training run by high quality providers of maths CPD, or indeed any events in the next few months where you can meet and share experiences with other maths teachers. Look for CPD Standard Holders (gold rosette) and/or Accredited Professional Development Leads (purple rosette). A list of providers, classified by the same system, can be found in the CPD Providers Directory.

New National Curriculum in Focus

New National Curriculum in Focus *is dedicated to unpicking the new curriculum and how to understand and develop the requirements of the new programmes of study for mathematics. You can find previous features in this series here.*

Assessment Materials

As we're reporting in this issue's News section, towards the end of July we published new materials designed to help teachers assess their pupils' understanding of mathematical concepts. Taken together, we hope they'll help teachers assess the degree to which pupils, over time, acquire mastery of the mathematics National Curriculum.

Before using them in the classroom, you might find it useful to browse them a little to familiarise yourself with their overall shape, and get a feel for the common features.

Each of the six documents (one for each KS1 and KS2 Year Group) starts with an introduction to teaching for mastery, followed by an explanation of how the materials are structured. For each year group, the materials are then split up into National Curriculum topics areas (Number and Place Value; Addition and Subtraction etc).

In each curriculum area, a handful of key Programme of Study statements is highlighted, and, underneath, the 'big ideas' they reflect. This is the context against which the questions, tasks and activities that follow should be used.

The questions, tasks and activities themselves follow the same pattern. The left hand column has content that all pupils should be expected to master. On the right is more challenging material, the tackling of which by pupils will help teachers assess where, and by whom, mastery with greater depth has been achieved.

As well as being of value to individual teachers, we hope the materials will prove a catalyst for discussion among groups of teachers before and after their use in the classroom.

Once the school year gets going, we'll explore means of enabling teachers to share experiences of using the materials and describing their pupils' responses to the mathematical activities they contain.

Mathematical Holiday Entertainment

The holidays may be upon us, but that doesn't mean that your engagement with maths has to stop! Last year's summer holiday issue has many good ideas - and here are some further suggestions:

Holiday Reading

- With the community of primary teachers beginning to wonder what mastery in mathematics means, there are a number of books that are closely linked that might help to challenge your own beliefs about what people and children are capable of. Pioneer of *Growth Mindset*, Prof. Carol Dweck's book Mindset is an inspiring read that will enable you to consider how a growth mindset will contribute to your beliefs about what you are capable of, and how you view what others are capable of. This is not a book written for educators nor is it a book about mathematics learning, but it may become clearer when you have read this why pupils might be considered to be poor at mathematics and why they believe they are.
- In a similar vein, author, Olympian and sports broadcaster Matthew Syed has written about the tension between talent and practice. His book *Bounce* presents examples of sportsmanship and discusses whether talent is more important than practice. Just as the theory of marginal gains that drove our British Olympic cycling team to success in 2012 and then fed into its application in education with marginal learning gains, so too could this book enable us to reflect on its application in the classroom.
- If you want to read something that will tease your mind, then look out for Alex Bellos's fortnightly Monday puzzle in *The Guardian*. Or if you want a longer read, try his books, *Alex's Adventures in Numberland*, and *Alex Through the Looking Glass*.
- Now is also the time to catch up on reading your ATM or MA journals. If you aren't already a member then you can find out more about the mathematical subject associations here. Membership benefits included discounted rates on their publications for teachers - for example, from the ATM's online shop or the MA's catalogue.

Films with a mathematical theme

- For those rainy days when you need an idea of a good film to watch, why not choose one with a mathematical theme? In the last year there have been two films that have hit the big screen: The Imitation Game loosely tells the story of Alan Turing's quest during World War II to crack the Enigma code, while The Theory of Everything is a biographical retelling of part of the life of scientist and mathematician Prof Stephen Hawking during his marriage to his wife Jane, who cared for him from the early stages of his illness.

Mathematical Days Out and Things to Do

- Maths on Toast is a charitable organisation that hosts a number of mathematics-related events for families throughout the year. Keep an eye on their website for upcoming activities that are held in London and other places around the country.
- The Royal Institution hosts summer schools throughout the holidays on a variety of interesting scientific and mathematical themes. Places get booked quickly but it's always worth phoning to check.
- If you have seen *The Imitation Game*, mentioned above, then maybe you might want to visit Bletchley Park itself, home to the codebreakers of World War II. They offer regular family activities as well as the exhibition which you can visit there.
- Did you know there is a museum at the Bank of England? You can find out about the history of our currency and role that the Bank of England has in terms of our economy.

Looking Back on a Year of Maths Teaching

What have you changed in your practice this year? We asked some teachers to share some reflections with us on what has changed in their classrooms and what has happened as a result of this:

- **Jo Creamer**, teacher and accredited PD Lead from Bristol, reflects on a simple question that she first encountered in a book, *What is the same? What is different?*

  I was teaching a Year 2 class when I read these questions in Derek Haylock and Anne Cockburn's book, *Understanding Mathematics for Young Children*. They changed my approach to teaching mathematics. Previously I had just corrected children who reversed numerals or confused 12 and 21 by rather lamely saying your 5 or 12 is the wrong way round. This was completely ineffectual: why would a child self-monitor when I was doing all their thinking for them? Using these questions which they had to answer was the beginning of me expecting children to explain their thinking. I discovered that I could use the same phrases with more complicated mathematics. Children surprised me in the way they were capable of noticing patterns and details. I clearly remember a child delighting in telling me what was the same and what was different about 5+3=8 and 8-3=5. He could then write me number sentences which followed this rule. I began to read about meta-cognition and used the probing questions from the National Numeracy Strategy. Children knew that I would not let them say 'I just know it' - they would have to tell me the maths thinking they did to get their answer. It created the learning environment I knew was right for learning maths.

- **Laura Nethercott**, NQT from Devon, reflects on her first year of teaching:

  As a NQT, working with 7-8 year olds, I have had the opportunity to develop my understanding of the impact of independence on standards in maths through a piece of action research. Inspired by the mastery curriculum, I realised that I needed to provide ways for the children to confidently access the same learning. This is where I found investigations and exploratory learning key. The children were immediately more engaged and willing to pursue their learning. I took away attainment groups, lifting the lid on both my own and the children's expectations. For example, in a recent investigation around adding three numbers to make a particular total, the children could be heard querying each other's calculations. Without taking away the attainment groups I don't believe the children would have been as likely to be challenged by, or to challenge, their peers. As a class we worked our way through the hundred square, trying to find all of the totals. By allowing the whole class to access this, I enabled all children to realise that their contributions were valued and that they could use other's reasoning to understand what to do. I have also spent time discussing how the children felt at points in their learning, and, if any child felt negative about their learning, we discussed ways to overcome this. Showing the children that they own their learning has been an eye-opener for all and has increased the children's love for maths. They now wonder about the maths they experience and look for patterns to make sense of the mathematical world around them.

- **Jessica Bowden**, teacher from Chatham, reflects on her involvement in a project run by the Kent and Medway Maths Hub, which focused on using manipulatives:

  We had real success using the Cuisenaire rods during our lessons on division. The children worked practically, finding out how many 5s were in 10, 15, 20 etc. They built the number rods and placed

them on top of each other. We then talked about how we could describe what they had found out, by saying "there are 4 groups of 5 in 20" etc. Once the children were really comfortable with this and understood what division meant, they then played division post box. This required the children to post through a division question to their partner (18 divided by 3) and their partner posting back the correct number of 3 rods. That way they found the answer. The result of using the rods at the beginning meant that the children were able to apply their secure understanding of division to a wide variety of problems. The children were really enthused by their learning and the use of the rods enabled the children to talk about what they were now able to do.

- **Dan Polak**, Y5 teacher from Devon who moved from secondary to primary four terms ago, reflects on his involvement in a piece of action research led by Devon Maths Team:

  We considered what high quality talk looked like and the subjects where you were most likely to encourage or encounter it. Talk for learning is a phrase which, while still used regularly, seems to have reduced in profile in the response to the challenging demands of the new curriculum. Considering the impact on a teacher's intervention and structure within the lesson, we felt that talk for learning was more important than ever.

  In PSHE we encourage high quality, child-led talk for learning by sitting them in a circle and allowing the children to drive the discussion themselves. When we did this at the beginning of our maths lessons, posing open ended investigations for the children to discuss in threes before feeding back to the whole class, we found that we could easily identify misconceptions.

  Our children also value questions and mistakes as a result of having ownership of the investigation early on. They put questions to the class and regularly decide to test hypotheses before drawing their own conclusions. Misconceptions can be readily identified by the teacher. One child proposed that 75% of 300 was 225 by adding 75 three times. I thought this was because he aware that you can think of 75% of 300 by using what you know about 75% of 100 and then repeating this to get 75 x 3 = 225 as 75% of 300. When another child suggested this is because one quarter of 300 was 75, the response was 'no, that's not why I did it, I counted up in 75s because it was 75%'. If I had seen this answer and method in this child's book, I would have assumed a solid understanding of the concept, and been quite wrong!

If you are inspired by these reflections, why not share your own in this thread in the Primary Forum, and linclude links to anything that you think will help others.

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Planning your Mathematics CPD for the next school year?

Here are some suggestions to consider:

ICME-13

- 2016 will see the 13th International Congress on Mathematics Education (ICME-13), which takes place in Hamburg, Germany, 24-31 July. You will be able to register from 1 November 2015, and a 'First Bird' rate of 370€ applies until 31 December. This event brings together experts and enthusiasts from the world of mathematics education.

Surfing the web

The internet provides a wealth of video material these days. You may be interested to watch some of these interesting clips:

- Caleb Gattegno was an educator interested in particularly (but not exclusively) in mathematics education. He developed materials and books to support the teaching of mathematics with Cuisenaire rods in the 1960s. This 1961 film of him working with children in Canada is worth watching, and is a timely reminder of what is possible if we believe that children are capable of learning, given the right resources and environment.
- This 36-minute clip of a grade 4 Shanghai lesson will have you engaged for the entire length. A superb example of a beautifully-crafted lesson that helps children to generalise the defining property of a circle.

A little social networking

Are you up to date with following who needs to be followed in the world of mathematics and mathematics education? The following tweeters may be of interest:

Mathematics from a local and national perspective

If you follow @MathsHubs you will see other Maths Hubs' tweets pop up, and you'll be able to follow your local hub for news of what they are doing. The National STEM Centre also tweets about mathematics education and other STEM subjects.

@JaneJonesHMI is Ofsted's National Lead for mathematics, and you can follow general news from @Ofstednews as well; @educationgovuk will often update you on mathematics-related news from the Department for Education.

Authors and researchers

@joboaler is a researcher and author who focuses on mathematical mindsets tweets regularly, and @alexbellos - featured elsewhere in this issue - posts about mathematics, including puzzles, and links to news reports related to mathematics.

@pfeg is a charity that promotes financial education and literacy. They promote their events and resources through their Twitter account.

Subject Associations

Don't forget to follow the subject associations such as the London Mathematical Society (@LondMathsSoc), the Association of Teachers of Mathematics (@ATMMathematics), and the Mathematical Association (@Mathematical_A), to stay up to date with association news and member benefits. There's also a joint primary group combined of the ATM and MA (@4MathsPrimary) who tweet about primary mathematics.

You can find more mathematical tweeters in last year's summer issue.