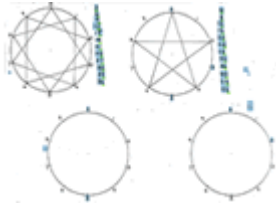




Welcome to our first Primary Magazine for the summer term. Following the popularity of our [article on fluency in addition/subtraction facts](#) in the previous issue, this time we hear from a Teacher Research Group in London that has been working on achieving fluency in multiplication/division facts with their pupils. We also offer some ideas for that chunk of time after the Y6 SATs – for inside and outside your classroom.

Don't forget all previous issues are available in the [Archive](#).



[Learning the Times Tables: teachers collaborate to find the most effective strategies](#)

A Teacher Research Group (TRG) from Camden, north London, consisting of 17 teachers from 10 primary schools, have been pooling their ideas and expertise, to find effective ways to help children learn, remember and - most importantly - understand and use their times tables. In this article, Kate Frood (head teacher at Eleanor Palmer Primary School) who led the group, summarises what they found. Those interested in learning more, can register their interest via the email address at the end of the article.



[Expanding Y6 Mathematical Horizons after SATs week](#)

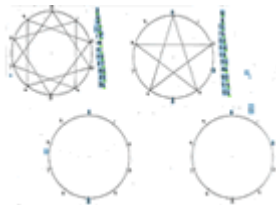
SATs are over – school's out for summer! Except it's not! There are weeks and weeks of the summer term left after the Y6 SATs. This article offers some ideas and inspiration for this period when teachers may be less constrained, and pupils less focused on tests.

And here are some other things to draw to your attention:

- A [new video](#) in our series of school leader interviews, focused on managing a move to teaching for mastery, is now live. This 20-minute interview shows Ben Strange, Deputy Head from Coleridge Primary School, and Louise Foulkes, one of the school's Assistant Heads, a Mastery Specialist, trained by the NCETM in conjunction with the (local) London North East Maths Hub.
- The Department for Education is holding a [consultation](#) about issues related to assessment in primary schools, including some maths-specific areas. All head teachers, teachers, and others with an interest in primary education are encouraged to respond; the consultation closes on **22 June**.
- A group of national maths organisations, led by the Institute of Mathematics & Its Applications (IMA), is collaborating to run a two-day maths festival in late June this year called [Greenwich Maths Time](#). Taking place at the University of Greenwich on 27 and 28 June, it's free and aimed at both teachers and pupils. [Find out more](#).
- [Cambridge Mathematics](#) has launched [Espresso](#), a monthly summary of an area of research in mathematics education. Topics so far have included [Number Sense and how it affects mathematics learning](#), [Assessing confidence, and how it affects learning and testing in mathematics](#), and [Issues in learning and assessing times tables](#).

Image credit

[Page header](#) by [Mari Helin-Tuominen](#) (adapted), [in the public domain](#)



Achieving Fluency in Addition and Subtraction Facts

by Kate Frood, head teacher at Eleanor Palmer Primary School, London

In September 2016, a group of teachers from ten Camden primaries (supported by [London Central and NW Maths Hub](#)) formed a Teacher Research Group to look at the learning of times tables. Our agreed goal was teaching children recall of times tables, to the level of automaticity. We perceived that if children can commit key facts to long term memory, then working memory is freed to apply to deeper and more complex learning (this observation is borne out by cognitive science research – see [Is It True That Some People Just Can't Do Math?](#) by the cognitive scientist Daniel Willingham, for example). However, we also shared an instinct that recall alone was not enough! We all know the child who can count in fives but cannot answer 7×5 at speed, or the child who can recall 5×6 but who cannot apply this to $? \times 6 = 300$. We shared concerns that the new Key Stage 2 arithmetic paper is leading to too much rote practice and 'tricks', encouraging children to use a taught method irrespective of the numbers involved (remember Q3 from last year's arithmetic paper " $326 \div 1$ "?).

Broadly we have four main conclusions to share:

- Teachers need a broad understanding of what fluency is to embed deep and permanent learning of key multiplication facts
- There are routines and strategies that help children to memorise key facts
- Clear messages that 'remembering stuff' is important, must be embedded in school culture
- Reasoning should be developed from the outset, alongside the expectation of fluent recall – a suite of simple routines and activities are needed to help with this.

What is fluency?

In [Developing Computational Fluency with Whole Numbers in the Elementary Grades](#) (2000), Susan Russell defined it as "a well-built mathematical foundation with three parts", as follows:

- Understanding the meaning of operations and their relationships to each other e.g. inverse, multiplication as repeated addition
- Knowing facts and how they relate to each other ("if we know this, what else do we know?" $4 \times 5 = 20$, so I know 4×50 etc)
- A thorough understanding of the base 10 number system, how numbers are structured in this system and how they behave in different ways in different operations eg $24 + 10 = 34$ and $24 \times 10 = 240$.

Real fluency combines a deep conceptual understanding with an ability to recall accurately and rapidly. It is not just repeating back the fact. It is about flexibility - efficiency - accuracy (Russell 2000). As a group, we wanted to emphasise the importance of this broader understanding whilst being uncompromising on the need to know stuff 'off by heart'.

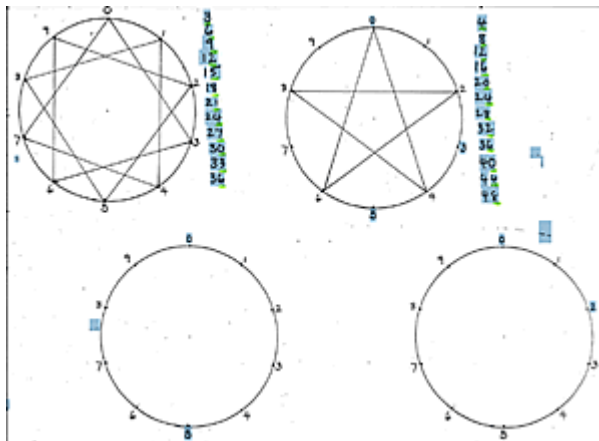
We concluded that fluency is about:

- Building conceptual understanding (of the facts we want them to learn)
- Building relational understanding (e.g. seeing the link between $4 + 5$ and $40 + 50$)
- Building an understanding of the structure of operations (e.g. 3×10 is the same as $10 + 10 + 10$).

How can we better support children in learning times tables?

Back in our classrooms we found that:

- The counting stick (and a colour-coded card set of each times table from 2-12) is a core resource and should be on hand at the front of the class at all times. It reinforces the patterns, makes visual the structure of repeated addition and enables connections to facts outside those being memorized, such as 30×4
- Chanting using the stick should happen on a daily basis. We found having a class 'table of the week' created better outcomes than juggling 30 individual programmes. We loved [this ATM video](#) with Jill Mansergh modelling strategies for learning tables
- The rich patterns of multiplication should be exploited from colouring on the hundred square to exploring patterns created by looking at the ones digits within each times table



(click to enlarge)

- The principle of 'start with what you know – build on what you know' is important. Reference to 'super-size' (30×4 , 700×8) and super-skinny (0.6×50), in Years 4, 5 and 6, should be introduced alongside each times table. This can serve to extend those who already know the core facts and makes key links to place value
- Weekly tables test, re-framed as 'quizzes' and thus less intimidating, should be a routine from Year 2
- Multiplication square visuals in clear and accessible places, really support children and could be left up during early tables quizzes
- Quizzes can be structured in a way that supports conceptual understanding and relational understanding. We constructed [this quiz](#) which had great results! We observed the less secure children referring back to 'Round 1' in order to answer Round 3. Not cheating – success!

Remembering stuff matters!

To support each of our schools and to deliver the core message that memorisation matters, we devised an inter-school 'Spring Slam' competition. All our Key Stage 2 classes took part in four rounds leading to a grand finale with the top child from each year group in each school attending and 'best in borough' crowns awarded.

Critical to the conception of this competition was that every child gave it a go and the submitted score (by set deadlines, to me as lead) was the class average score. A lower-attaining child immediately improved by seven marks in Round 2 by understanding what happens when you multiply by zero, contributing to an increase in the class average. To incentivise the higher-attainers, there were a bonus

five points for a 50/50 score, highlighting those who didn't check! League tables were hotly anticipated and enabled us to benchmark our own children. Every class made significant progress over the competition, from 2-25% improvement.

Here is a [sample quiz from Round 1](#) (Y5 & 6).

The key learning as we constructed and reviewed each round was the shift to assessing deep understanding and secure fluency. For Years 5 and 6 (who were scoring high class averages based on recall alone in Rounds 1 and 2), we re-designed next rounds to include: empty boxes, division, super-size and super-skinny questions. Here is a [sample quiz from Round 4](#) (Y5 & 6).

Average scores plummeted by 8-10 points. There was a clear next step for many of our classes!

Routines to develop real fluency

Perhaps our greatest learning was the need to develop reasoning alongside fluency. We remembered, devised and tested many simple whole class routines that develop this deeper understanding. All centred around pupil talk and about the properties of numbers such as prime, factor, multiple, square, odd, even. We found that children were really empowered by being given a language to talk about numbers and they loved the activities Here is an example of one such activity:

ALL, SOME, NONE

Write three or four random numbers on the board. Pupils talk with a partner, using a whiteboard and pen if that helps, to construct three sentences about those numbers, using the words 'all, some, none?'

E.g. 2, 7, 11

"**All** of the numbers are prime"

"**Some** of the numbers are odd"

"**None** of the numbers are factors of 15"

All these statements lead into some lovely teacher-pupil dialogue.

We have set ourselves the goal of bringing all our learning together by the end of this school year. If you are interested in a copy of our final book, including templates for the Spring Slam Rounds and the structured quizzes, register your interest by emailing admin@eleanorpalmer.camden.sch.uk.

Kate says "'Digging Deeper' articles from Issues [88](#) and [91](#) of the NCETM Primary Magazine inspired and guided us"

Those interested in reading a summary of the research regarding learning of times tables should visit Cambridge Mathematics' new [Espresso](#) site – expertly filtered research aimed at maths teachers. Specifically, [Issues in learning and assessing times tables](#).



Expanding Y6 Mathematical Horizons after SATs week

SATs are over – school's out for summer! Except it's not! There are weeks and weeks of the summer term left after the Y6 SATs. Depending on your school's approach, there will have been more or less emphasis on the importance of the key Y6 week in May. Much as SATs should be a snapshot of how a cohort is doing, rather than something that pupils are drilled for relentlessly, there is inevitably a sigh of relief when they are over. For any Y6 teacher and their class, the tempo changes to some degree.

How do we manage that tempo change? Some pupils may be exhausted, some may be hard to motivate, some may feel they have seen enough maths for this term, thank you very much. How does your school's scheme of work deal with this period?

Our primary team at the NCETM is expanding, and in this feature, we ask two of our new primary Assistant Directors, for their ideas for Y6 in the post-SATs summer period.

[Emma Patman](#) suggests spending some time on practical, financial education. She says:

In an ever changing and demanding society when it comes to money, it is vital we equip children with financial skills and knowledge to cope with issues such as debt, savings, earnings and spending. Having asked some lower Key Stage two pupils, 'Where does money come from?', I was mildly startled by their answers: 'The machine in the wall', 'It just gets printed' and 'The shop' (perhaps alluding to getting cashback?). Here are some ideas we tried at my school:

- We liked using the stories from [Values, Money and Me](#). In particular, I enjoyed using the [Finders Keepers](#) story with KS2 children. The children debate what the characters should do when they find some money, and share their first-hand experiences.
- In a village school, links with the community are particularly important, and children are encouraged to go and use their maths skills to buy fresh fruit and vegetables at our local greengrocers. Pupils gain practice in handling money, using the language of transactions (good manners etc), working out what they can afford, walking safely to the shop etc.
- My Money Week is an initiative from the Personal Finance Education Group (pfege). This year it is running 12-18 June.

The Primary materials are published in the form of a [downloadable newspaper](#) aimed at pupils and explore topics such as budgeting, saving and charitable giving. Comprehensive teacher notes are also provided. Schools are not expected to stick to the My Money Week dates - the initiative is designed to be flexible and adaptable so that activities can be changed to meet the needs of individual schools. Resources are available for use at any time, and previous years' materials are still on the website. From this year's resources, we particularly like:

- **Let's Paaaarty!** discusses the expense involved in throwing a child's birthday party. It offers some good discussion about pester power and pupils can consider what is really important for a birthday party (e.g. having fun with your friends) and at how money could be saved by, for example, making your own invitations.



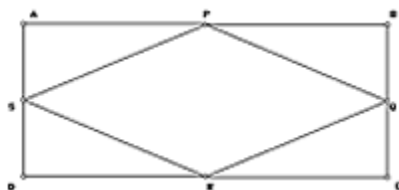
- **SoS – Save our sweets** addresses the issue of ‘shrinkflation’ - favourite sweets decreasing in size but staying the same price. The activity is designed to stimulate discussion and get pupils working on fractions. They could also look at why companies might do this and what might be causing the companies’ costs to rise. They could then write letters to chocolate manufacturers voicing their views.

[Alison Hopper](#) has these two ideas up her sleeve:

Investigating Shapes made by Midpoints

This activity investigates the shapes made by joining the midpoints of the sides of quadrilaterals, with a [curious and unexpected result](#).

Long loops of string or elastic help to introduce this activity, using physical movement in the playground.



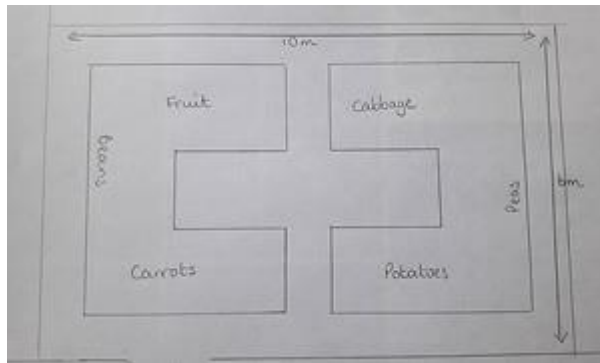
Four children hold the string/elastic in the shape of a rectangle. Four more children go and stand at the midpoints of each side. What shape is created if these four points are joined (string/elastic handed to the midpoint children helps create the new shape)? Repeat by forming and joining the mid points of this new shape.

What questions could we ask about these shapes? What predictions could you make about these shapes? What have we found? How can we be sure? How can you convince others?

Children can be given, or helped to create, a series of possible statements and questions to use as starting points. For example:

- Will the pattern of shapes be the same if you start with a trapezium?
- Does the ratio of the long and short sides stay the same in all the shapes created?
- The area of each new shape will be half the area of the previous shape.
- The perimeter of each new shape will be half the perimeter of the previous shape.

Digging for Victory



(click to enlarge)

Designing a 'Dig for Victory' garden plan is a great way to bring maths into your WW2 project. Children can mark out the plot size on the playground in chalk and then investigate how wide paths have to be and what the best size is for a bed so that it can be weeded easily.

- Details can then be given about space required for different crops to grow, so the children can then draw up a planting plan.
- Given growing times from planting to harvesting, pupils can work out when different crops need to be planted and which will be ready at the same time for harvesting.
- Children can also cook recipes using the ingredients which would have been grown. Recipes give opportunities for scaling and proportion, mass, capacity and time calculations.

Further suggestions from the NCETM magazine team

- Take some time to explore the visual beauty of maths. It's easy to see mathematics in visual patterns and other artworks. However, it is harder to know how to use art to learn maths (or vice versa). [Maths2Art](#), [Artful Maths](#), and [NRICH's selection of art-related resources](#) offer some great ideas, as well as our own archive of [The Art of Mathematics articles](#).
- Starting by working out the probability of getting a dry day, now is the best time of year to get your class outside to appreciate the maths in the world around them, or to be able to physically participate in some mathematical activity on a larger scale. No shortage of inspiration from [Creative Star – Maths Outdoors](#), [7 Fun Ideas](#), or this [Maths Treasure Hunt](#). For those interested in pursuing outdoor learning of maths in more depth, the NCETM's [Learning Maths Outside the Classroom](#) pages are a good place to start. And previously in the Primary Magazine, we had a four-part series about maths trails - see Issues [52](#), [53](#), [55](#) and [56](#).
- With transfer to secondary school uppermost in the minds of your class, these weeks may be ideal time to liaise with local secondaries to smooth the transition. Secondary teachers are likely to have more time post-exams to consider their new intake and will need to re-configure their expectations of Y7s under the new national curriculum. Beginning a project, that is continued in Y7, can be a nice way forward with this – for example the [Y6 Spirals Project](#) from Lancashire Grid for Learning (with continuation, Y7 Golden Number Project).