# A number puzzle

'Maths mastery' is gaining traction as the preferred educational approach in schools, but is it appropriate for the youngest children, asks ***Charlotte Goddard***

PHOTOS FROM NETLEY PRIMARY SCHOOL, CAMDEN; CASE STUDY OF PRINCE EDWARD PRIMARY SCHOOL GUZELIAN; ADOBE STOCK

'Mastery' is the buzzword when it comes to teaching maths. In its draft document setting out proposed changes to the EYFS framework, for example, the Department for Education says children should develop 'a secure base of knowledge from which mathematical mastery is built'.

However, there are a number of ways that 'maths mastery' can be interpreted, both broad and narrow. The term can be used to refer to a specific way of teaching maths which originates in Shanghai, Singapore and Hong Kong. A teacher exchange between China and the UK was followed by the Government-funded development of the Teaching for Mastery programme led by the National Centre for Excellence in the Teaching of Mathematics (NCETM).

On the other hand, 'mastery orientation' is a wider concept above and beyond the specific Teaching for Mastery programme. A concept is considered mastered when learners can represent it in multiple ways, can communicate solutions using mathematical language, and can independently apply the concept to new problems. Each time children return to a subject it is at a deeper level, so they are able to approach a task with a level of familiarity, allowing them to become more motivated and confident.

## MATHS MASTERY CONCERNS

Early Education's commentary on the draft revisions to the EYFS framework, published last summer, highlights concerns about the Government's bandying about of the term 'mastery'. 'The use of the word "Mastery" in the preamble, linked with the word "knowledge", may mislead people into thinking this is about a particular programme (Maths Mastery) – which is intended for older stages, not the early years,' it says. 'Better to avoid the word because of this likely misunderstanding.'

Di Chilvers, advisory consultant in early education at WatchMeGrow and an Early Education associate, is concerned that some schools are starting to implement a watered-down version of Teaching for Mastery in Reception classes. 'In the proposed revision of the EYFS, the DfE equates knowledge with mastery, but mastery is more about having a deep understanding which supports knowledge,' she says.

'Often schools are diluting Year 1 mastery programmes for younger children, which is not helpful for many reasons. They are not a substitute for having a really good understanding of young children's mathematical development from the ground up. In Talk for Maths Mastery we focused on maintaining the mathematical momentum of children's development and learning which starts from the direction of birth onwards and not top down.'

The concern is that schools have bought into commercial mastery programmes in the same way that they have with phonics schemes, and that these programmes do not prioritise the independent play and continuous provision which allows young children to consolidate what they have learned through adult-led interactions or through their own explorations.

'In the EYFS, children are learning through first-hand experiences, whereas the mastery programmes follow whole-class teaching methods, with children using abstract workbooks rather than playing and exploring with concrete materials in meaningful contexts,' says Ms Chilvers. 'Children in Reception need to engage collaboratively in child-led play with open-ended materials, having time to deepen their talking and thinking.'

## MASTERY ORIENTATION

The overall concept of mastery orientation, however, does sit well with the principles behind the EYFS, says Sue Gifford, principal lecturer at the University of Roehampton's School of Education. 'I define mastery as making really sure children are understanding and can apply what they have learned in different contexts,' she explains.

'A mastery approach is also inclusive: you don't label and group children by ability as happens in a lot of Reception classes. We are aiming for mastery in maths in the early years in that we are saying all children will leave this Reception class understanding the numbers up to ten, not "all children except for the lower attainers".'

> **Often schools are diluting Year 1 mastery programmes for younger children, which is not helpful for many reasons**

Ms Chilvers worked with 12 schools to explore what maths mastery looks like in the early years, as part of the Talk for Maths Mastery initiative. 'The concept of mastery is very different in early years,' she says. 'It is called Mastery Orientation and includes many aspects of the Characteristics of Effective Learning, particularly creating and thinking critically.'

In the early years, maths mastery is about deepening understanding of concepts – rather than moving on to more complex numbers; for example, teachers ensure that children have a thorough understanding of numbers they already know, by being able to use them in their play to set and solve problems. Children can revisit different ➤

### case study: Prince Edward Primary School, Sheffield

As part of Talking for Maths Mastery, Prince Edward Primary School audited nursery and Reception provision, looking at where in the setting children were having conversations about maths and where the talk was less maths-related. 'We found hot and cold spots, and where there were cold spots we looked at how we could introduce maths into these areas authentically as part of a child's everyday experience,' says Katie Hulme, Foundation Stage 1 class teacher.

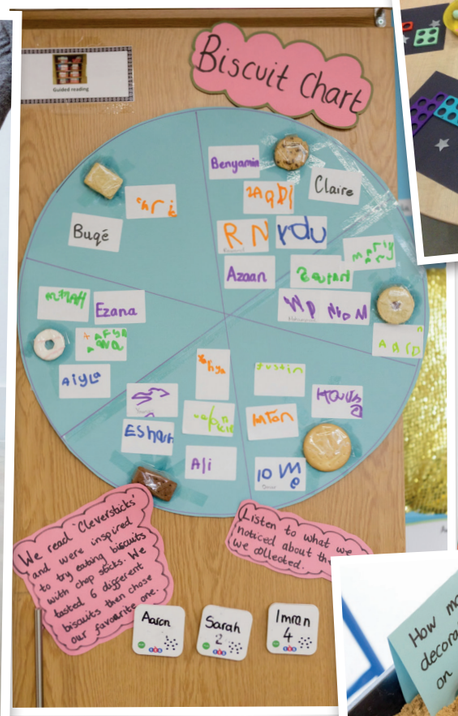
Every practitioner filled in a Maths is Everywhere sheet recording where they could see maths happening, what children were doing, and what kind of maths it was. 'This helped us tune into the maths the children were already doing rather than dragging them away to do the maths we wanted them to do,' says Ms Hulme. 'We looked not just at what they were playing with but how they play and their patterns of behaviour, and how we can extend that.' Hotspots included the block area and water tray, while coldspots included role play and the small-world area.

The school decided to collect different sizes of the same animal and put them out in the small-world provision for the children to access. They were labelled with a photograph so the children were able to see where they belonged. 'This encouraged much more discussion about size among the children,' says Amy Parker, EYFS leader.

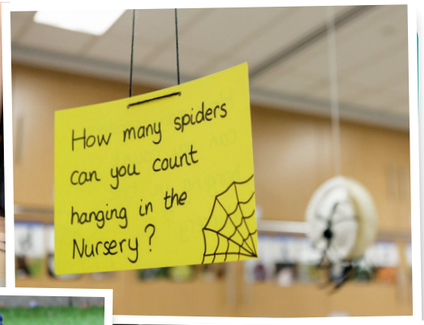
As a particularly diverse school, Prince Edward also decided to increase its use of resources from different cultures, to make sure there were resources which children could identify with in the role-play and small-world areas, as well as other parts of the classroom. A whole-class maths activity looking at Islamic art led to children making their own patterns using tessellating blocks, which were put out for children to access independently.

# EYFS best practice in schools

## case study: Netley Primary School, London Borough of Camden










Netley Primary School, which first opened its doors in 1883, is situated on the state-of-the-art Netley campus in Camden, north London. Forming part of the campus is the Outstanding-rated Woodlands Centre for children with autism.

As a result, explains Janine Davenall, Netley's head of early years, 'Everyone in our community is encouraged to sign, using Makaton, so when children come from the centre to the mainstream provision for an inclusion session, we have a method of communicating.'

Makaton is used as part of early years maths teaching within the school, allowing children to learn mathematical concepts using their whole body.

'We would use a Makaton sign for "subtraction", which is a straight arm across the body moving away; for "equals", using two arms in a parallel and rocking up and down; and "addition" is a horizontal arm and vertical arm moving across it so making a plus sign with your body,' says Ms Davenall.

At Netley maths is embedded into the daily routine. At snack time Reception children are encouraged to 'pay' for their food and drink with Velcro pennies. 'The children have a little money box and have six pennies a day — they pay a penny for fruit, and 2p for milk, and water is free,' says Ms Davenall.

There are also plenty of opportunities for mathematical learning during tidy-up time. Children can find the 'shadow' shape of objects like scissors or Sellotape, showing where they need to be replaced on the shelf, for example.

Practitioners might also pose questions that require the children to think mathematically. 'We might say we put out five calculators, but now there are three – how many are still missing? Can you go and find them?' says Ms Davenall.

Story and rhyme time is also full of mathematical learning opportunities. 'In the two-year-old provision, we focus on a different rhyme every month,' says Ms Davenall. 'This might have a maths focus, such as Five Little Monkeys, or One, Two, Buckle My Shoe. At other times children will choose the rhyme. In nursery, we have a rhyme a week which is also shared with parents, and is often about counting.'

The concept of the key person is an integral part of the school's early years pedagogy, from its two-year-old provision right through to Reception class. 'We balance first-hand experiential learning, following children's interests, with adult-led learning moments,' says Ms Davenall. Core mathematical concepts are taught within 'island time', small-group time spent with the key person.

'For a two-year-old, it will be really fast, they will have island time for a maximum of ten minutes,' she explains. 'It might be we say, "Can you place the big teddy in the small box?" At nursery we may be thinking about different words for big, like "ginormous" or "huge".'

concepts – not just numbers – as they follow their interests, and practitioners can observe if children have understood and connected this learning to previous experiences in their child-initiated learning and activities.

### ADULT'S ROLE

We need to find the right balance between child- and adult-led learning, says Dr Gifford. 'We have sometimes seen adult-led number-focused activities as inappropriate for nursery,' she says. 'We are learning you can have playful adult-led activities. Unlike shapes, numbers are an invented system, so children do need to learn it from adults.'

**In early years maths, the adult's role includes:**

- introducing interesting stories to give maths a context
- encouraging 'serve and return talking' and sustained shared thinking
- helping children organise their thoughts and take responsibility for next steps
- providing resources and encouraging independent use
- using open-ended questions to stretch a child's thinking and give clues to solve problems
- modelling the correct mathematical vocabulary.

There should also be plenty of opportunities for child-led play, as this is where children can connect what they have been taught to everyday contexts and experiences where it makes more sense to them.

> **Child-led play is where children can connect what they have been taught to everyday contexts**

Ms Chilvers worked with a group of Reception children who had shared the Julia Donaldson and Axel Scheffler story of *Superworm* and independently decided to make their own worms out of string and compare them.

The teacher suggests they order them from longest to shortest. During this play the children naturally used vocabulary of size and measure, and recognised a pattern – short, longer, longest. They checked with each other that they had their worms lined up, recognising the importance of a fair test.

### SCHEMATIC PLAY

Schematic play particularly highlights the inherently mathematical nature of children's development, but it is not an aspect that is widely understood in schools, says Ms Chilvers.

Schematic play is characterised by being repeated in many areas, and when children are exploring their schemas they are usually absorbed, with high levels of involvement. Schemas such as trajectories, transporting, enclosure and enveloping can all be used to introduce new mathematical ideas, consolidate learning and encourage critical thinking, by tuning into a child's interests.

### EARLY LEARNING GOALS

The National Centre for Excellence in Teaching of Mathematics (NCETM) lists six main areas of learning for early years maths:

- **Cardinality and counting** Understanding the cardinal value of a number refers to the quantity of things it represents.
- **Comparison** Understanding that comparing numbers involves knowing which numbers are worth more or less than each other.
- **Composition** Understanding that one number can be made up from two or more smaller numbers.
- **Pattern** Looking for and finding patterns helps children notice and understand mathematical relationships.
- **Shape and space** Understanding what happens when shapes move, or combine with other shapes, helps develop wider mathematical thinking.
- **Measures** Comparing different aspects such as length, weight and volume, as a preliminary to using units to compare later.

However, the proposed new Early Learning Goals for mathematics now focus only on number and numerical patterns with no reference to shape, space, pattern and measure.

'This single-minded focus on number is bewildering,' says Ms Chilvers. 'Children are inherently mathematical and are interested in shape, size, comparison – who is the tallest, smallest, oldest, youngest. The Department for Education suggested that shape, space and measure would be included in the curriculum, but in practice, schools and settings will focus on what it says in the statutory framework.'

# EYFS best practice in schools

Spatial awareness is a particularly neglected area of mathematics, says Dr Gifford. 'In other countries there is more of an emphasis on the idea of perspective, but here it has narrowed to naming shapes,' she says. 'Teachers are not as clear about what a child's learning journey looks like when it comes to shape and space as they are with numbers.'

This is not to say learning about number value is not important. 'Focusing on the values of numbers to ten is a good idea, although children also need to count reliably above that, in advance of understanding the values,' says Dr Gifford. 'People say that is just rote counting but that is important as well, alongside understanding.'

Subitising, the ability to quickly tell the number of objects in a set without counting, is another important skill to develop in the early years.

## ENVIRONMENT AND RESOURCES

Little and often is the key to mathematics in the early years, with maths embedded in all aspects of the environment and daily routine: snack time, tidy-up time, storytime, outdoor play.

Numbers made of different materials such as gel and wood give children a chance to explore them physically. Dice games are ideal for counting backwards and forwards, subitising, and throwing a number and collecting that amount of objects. Open-ended resources such as playdough and string allow children to bring mathematical concepts into their own play. Blocks introduce ideas about the properties of shapes and how they fit together, as well as measurement – how tall is that tower?

Cooking is a popular way of introducing mathematical concepts such as measuring to children, many of whom are very interested in food. It visits a number of concepts such as measure, and problem-solving.

Dr Gifford, however, suggests games can be more effective than one-off activities. 'Cooking doesn't give you the repetition you get in games,' she says. 'Children focus on stirring and eating but only count once, it is not the same as repeatedly throwing dice and collecting the number of objects.'

Outdoors should also be a number-rich environment. Chalk, hoops and bean bags can be used for games of throwing bean bags into hoops with different numbers inside. Games such as snakes and ladders can be painted onto the ground and played with outsize dice, while mud kitchens provide opportunities for measurement.

Just looking at a child's play shows they are inherently mathematical. When adults can tune into the maths children are already doing, through the provision of appropriate pedagogy, resources and environment, the opportunities are endless.

**FURTHER READING**

- **www.earlylearninghq.org.uk/numeracy** – a collection of early maths resources
- **www.learningtrajectories.org** – early maths experts Douglas Clements and Julie Sarama's Learning Trajectories is a US website with useful information about the different learning paths children take to reach mathematical learning goals
- **www.foundationyears.org.uk/mathematical-resources** – a list of websites, picture books, games and other resources that support early years maths
- ***Talk for Maths Mastery – maintaining the momentum of children's development and learning***, edited by Di Chilvers, https://watchmegrow.uk/resources/resource-tools/talk-maths-mastery-maintaining-momentum-childrens-development-learning
- 'All about... embodied learning' and 'All about... spatial reasoning' by Dr Jennifer Thom are at **www.nurseryworld.co.uk**

## NW conference: new Ofsted framework

Maths will be one of the subjects up for discussion at our conference on the new Ofsted inspection framework in London on 9 July.

Under the new system, Ofsted will prioritise the quality of the curriculum and pedagogy, rather than outcomes data, and assess provision and practice under a new judgement, 'Quality of education'.

'Delivering high-quality education under the new inspection framework: Intent, Implementation and Impact' combines general guidance, subject-specific advice and case studies, so enabling practitioners from across the sector to plan and deliver an early years curriculum and develop a vision of 'quality education' for the children in their setting.

**For full programme details and to book a place, visit: www.inspectionconference.co.uk/home**

**SPEAKERS**

**Early years consultants Kym Scott and Helen Moylett and (centre) LEYF chief executive June O'Sullivan**