



# MathShed

What is meant by mastery in  
mathematics and how to use  
MathShed to incorporate it  
into your classroom



What is meant by mastery in mathematics and how to use MathShed to incorporate it into your classroom



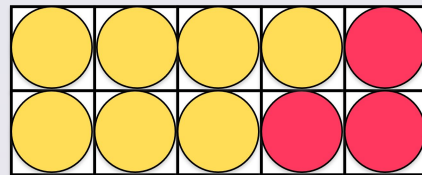
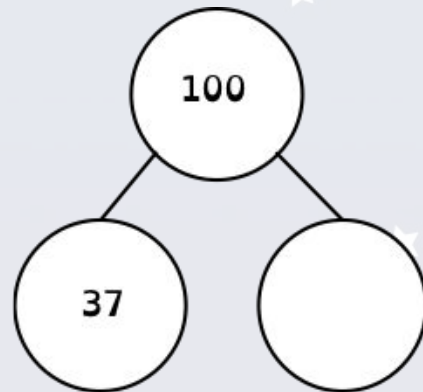
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## What is mastery in mathematics?

The term 'mastery' means pupils acquiring a profound, secure, lasting and adaptable knowledge and skillset in mathematics.

It refers to children being given a solid grounding in the fundamentals of mathematics, such as times tables, number bonds and other key facts and mental methods, to allow children to progress fluently within deeper levels of mathematical thinking.

Teaching for mastery applies a similar principle to Carol Dweck's 'Growth Mindset': given ample opportunity and support, if not all then most children can become competent mathematicians.



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## Where do Mastery principles originate from?

The 'Mastery' initiative in the UK was instigated by a desire to rank higher as a nation in the PISA tables for mathematics after a series of low rankings in the 2010s.

The methodology is inspired by best practice in top performing regions, Shanghai and Singapore.

**2018 PISA Table for Mathematics**

Rank	Country Name	Score
1.	China (Beijing, Shanghai, Jiangsu, Zhejiang)	578.7
2.	Singapore	556.3
3.	Macau	542.3
4.	Hong Kong	530.7
5.	Estonia	525.3
6.	Japan	520
7.	South Korea	519.7
8.	Canada // Taiwan	516.7

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## How mastery in mathematics relates to the National Curriculum

- [Pupils are expected to] become **fluent in the fundamentals of mathematics**, including through **varied and frequent practice** with **increasingly complex problems over time**, so that pupils develop **conceptual understanding** and the ability to **recall** and **apply knowledge rapidly and accurately**
- The expectation is that **the majority of pupils will move through the programmes of study at broadly the same pace**. However, 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 [**same-day interventions**], before moving on.

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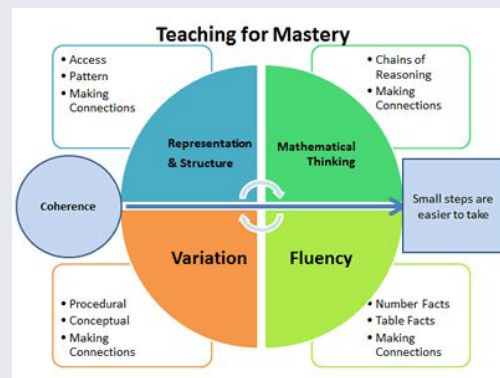


## The NCETM'S 'Five Big Ideas' and how they have influenced teaching for mastery in mathematics

The 'Five Big Ideas' were developed by the NCETM and its Maths Hubs to provide a focus for their Mastery Specialist development programmes. It draws upon the research that instigated and ongoing research into the efficacy of the NCETM's work in mathematics mastery.

The diagram on the right has become synonymous with how best to synthesise and express what mastery mathematics is at its core:

1. Coherence
2. Uses of representations and structure
3. Incorporation of procedural and conceptual variation
4. Focus on fluency: number bonds, times table etc.
5. Mathematical thinking: regular opportunities for reasoning and problem solving



Source: [NCETM website](https://www.ncetm.org.uk/teaching-for-mastery)

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## Coherence

In essence, coherence refers to the way that mastery mathematics curricula have lessons that each focus on a small step, with each step following on from the previous lesson and leading onto the next lesson.

With MathShed, each lesson is a small step of its own and within each lesson we provide even smaller steps, providing micro-differentiation where each question or activity is marginally more difficult or complex than the last, allowing children to assume and process new concepts over time and across multiple contexts.



Example small step lesson sequence  
(Year 2 Fractions)

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## Representation and Structure


It is key that the representations and structures used for each lesson are in line with the stage children are at in that moment of exploring or consolidating their understanding of a new concept.

So, for example, when teaching place value, providing children with Base 10 (Dienes) equipment, then moving on to using place value counters within place value charts, to then having children work with digits in place value charts and finally working through place value entirely in the abstract with children no longer needing the prior equipment and representations as a scaffold.



To be able to add and subtract multiples of 100 


Activity 1:  
Complete the sentences below.

4 ones and 2 ones equals 6 ones.

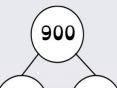
To be able to add and subtract multiples of 100 

Activity 2:  
Complete the table below:

sketch	part-whole model	worded form	number sentence
			

To be able to add and subtract multiples of 100 

Activity 3:  
Use the part-whole model to write as many number sentences as you can.



$700 + 200 = 900$     $900 - 200 = 700$   
 $900 = 700 + 200$     $700 = 900 - 200$

Year 3 - Autumn Block 2 - Addition and Subtraction -  
Lesson 1 - To be able to add and subtract multiples of 100

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## Mathematical Thinking

To ensure children have a deep understanding of key facts and new concepts in mathematics, it is essential that they have a diversity of opportunities to think through and discuss their learning. They must regularly be offered the chance to think deeply, reason about and discuss their queries and solutions with adults and peers.

It is for this reason that within MathShed resources you will find plenty of Talking Time questions, plenty of reasoning tasks as well as reflective Evaluation questions in our lessons.

To be able to discuss the concept of area



Talking Time:  
area (noun)

The **area** of a surface such as a piece of land is the amount of flat space or

To be able to discuss the concept of area



Talking Time  
How many yellow squares do I need to cover the shape below?



To be able to discuss the concept of area



Evaluation:

The darker blue shape on the right is bigger than the other shape.



Do you agree?  
Explain your answer.

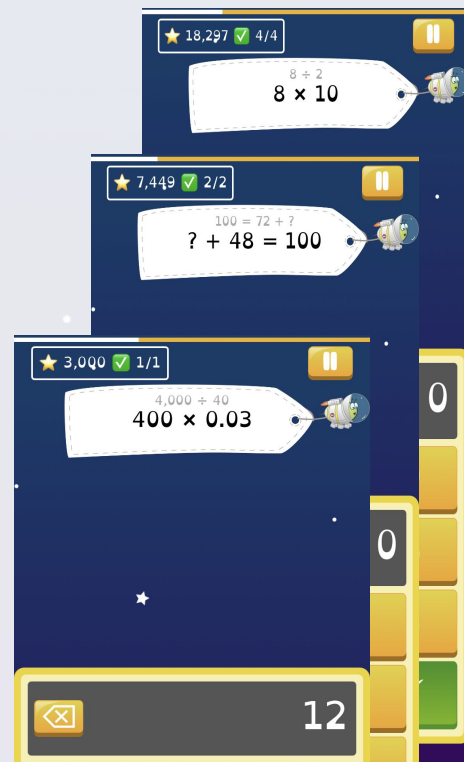
Year 4 - Spring Block 2 - Area - Lesson 1 -  
To be able to discuss the concept of area

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## Fluency

Fluency refers to children being able to recall key facts (number bonds, times tables) with automaticity and procedures (mental methods, such as adding two-digit numbers) at speed and with efficiency. Children should also be able to do so when presented with similar facts or procedures with different surface structures: an ability to switch between different mathematical equipment or pictorial representations with ease.

To achieve fluency, children need regular varied arithmetic practice which is why MathShed provides multiple resource lines (Quick Maths - our daily arithmetic fluency scheme; our abstract fluency web game/app; and our varied fluency question sets) to support children recall facts and procedures with automaticity.



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### Variation

Well-applied variation comes in twin forms.

First, it refers to the different ways teachers might represent the new concept at hand, doing so in as many ways as is helpfully possible, highlighting key characteristics, which helps in developing a sure, profound understanding of mathematics.

To be able to explore the relationship between decimals and fractions greater than 1



Activity 1:

To be able to explore the relationship between decimals and fractions greater than 1



Talking Time:

Express the representation shown below as a decimal, a decimal in its expanded form, a fraction, a fraction in its expanded form and in worded form,



decimal: 4.35

decimal (expanded):

$4 + 0.3 + 0.05$

fraction:  $4\frac{35}{100}$

fraction (expanded):

$4 + \frac{3}{10} + \frac{5}{100}$

To be able to explore the relationship between decimals and fractions greater than 1



Talking Time:

Referring to the representation, complete the statement below.



$$1.73 = \frac{173}{100} = 1\frac{73}{100}$$



Year 5 - Spring Block 3 - Decimals and Percentages -  
Lesson 3 - To be able to explore the concept of thousandths

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## Variation (continued)


Second, it refers to how well each small step of learning is sequenced, not just lesson-to-lesson or day-to-day but within lessons and week-to-week too, allowing opportunities for recall practice, highlighting what is the same from previous learning and what has changed or become more advanced. It also means drawing children's attention to the importance of mathematical structures and the relationship between each to the others.

One of the ways we have achieved this in our MathShed teaching sequences is by providing Starter activities that tend to follow on from previous learning but also signpost where learning is headed next.

To be able to explore the relationship between decimals and fractions greater than 1

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**Starter:**  
Expressing the representations below as both fractions and decimals, what's the same and what's different?

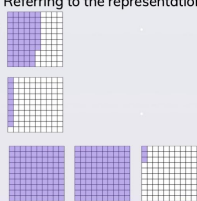


Explain your answer.

To be able to explore the relationship between decimals and fractions greater than 1

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**Activity 1:**  
Referring to the representations, complete the statements below.



$0.57 = \frac{57}{100}$

$0.09 = \frac{9}{100}$

$2.03 = \frac{203}{100} = 2\frac{3}{100}$

Year 5 - Spring Block 3 - Decimals and Percentages -  
Lesson 3 - To be able to explore the concept of thousandths

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1. Competence grid demo
2. Resources and digital assignments demo  
(online lessons for same-day interventions)
3. Any questions?