How to build problem solving, fluency and reasoning in the classroom while following the new national curriculum

Maths No Problem

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Our national curriculum – what’s new?

• higher expectations overall

• a greater emphasis on number arithmetic

• less prominence given to data, with probability removed altogether

• a steer away from use of calculators until the later primary years
Our national curriculum – what’s new?

The national curriculum for mathematics aims to ensure that all pupils:

• become **fluent** in the fundamentals of mathematics, including through varied and frequent practice, so that pupils develop conceptual understanding and recall and apply knowledge

• **reason mathematically** by following a line of enquiry, conjecturing relationships and generalisations, and using mathematical language

• can **solve problems** by applying their mathematics to a variety of routine and non-routine problems
Our national curriculum – what’s new?

“The expectation is that the majority of pupils will move through the programmes of study at broadly the same pace.”

“Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content.”
New NC: a mastery curriculum

• An expectation that all pupils can and will achieve.

• The large majority of pupils progress through the curriculum content at the same pace. Differentiation emphasises deep knowledge and individual support/intervention.

• Teaching is underpinned by methodical curriculum design, with units of work that focus in depth on key topics. Lessons and resources are crafted carefully to foster deep conceptual and procedural knowledge.

These are the first three points of five taken from the NCETM’s paper on Mastery
# A mastery curriculum

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<td>Shape and patterns</td>
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Problem solving

**Reasoning**
- Apply mathematics
- Break down problems & persevere
- Conjecture relationships & generalisations
- Mathematical language

**Fluency**
- Rapid & accurate recall
- Conceptual understanding

Mathematics Mastery
A framework for mastery

Conceptual understanding

Mathematical problem solving

Mathematical thinking

Language and communication
Conceptual understanding

- Bead strings
- Dienes blocks
- Fraction towers
- Cuisenaire rods
- Multilink cubes
- Bar models
- 100 grids
- Number lines
- Shapes

Mathematical thinking

Mathematical problem solving

Language and communication
Mathematical language

- Conceptual understanding
- Mathematical problem solving
- Language and communication
- Mathematical thinking
Problem solving

Reasoning
- Apply mathematics
- Conjecture relationships & generalisations
- Mathematical language

Fluency
- Rapid & accurate recall
- Conceptual understanding
We believe that pupils should:

- Explore, wonder, **question** and conjecture
- **Compare**, classify, sort
- Experiment, play with possibilities, **modify** an aspect and see what happens
- Make theories and predictions and act purposefully to see what happens, **generalise**

“Mathematics can be terrific fun; knowing that you can enjoy it is psychologically and intellectually empowering.” (Watson, 2006)
Mathematical thinking

The National Centre for Excellence in the Teaching of Mathematics (NCETM) has produced progression maps for different strands of mathematics within the NC at KS1-3 [www.ncetm.org.uk/resources/44672](http://www.ncetm.org.uk/resources/44672)

It has added questions to each section within the strands to encourage discussion and reasoning. These include:

- What do you notice?
- Spot the mistake
- True or false?
- Give an example of...
- Odd one out
- Continue the pattern
- Do, then explain
- Convince me/prove it
Problem solving

Reasoning

- Apply mathematics
- Conjecture relationships & generalisations
- Break down problems & persevere
- Mathematical language

Fluency

- Rapid & accurate recall
- Conceptual understanding
Mathematical thinking

Nrich ‘One Big Triangle’ problem http://nrich.maths.org/192/index
Problem solving

Apply mathematics

Break down problems & persevere

Conjecture relationships & generalisations

Mathematical language

Rapid & accurate recall

Conceptual understanding

Reasoning

Fluency
Mathematical thinking
Problem solving

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Fluency

Mathematics Mastery
Mathematical thinking

When one of the parts goes up by one, what happens to the other part?

Are there more number bonds to make 7, or to make 9? Why?

How do you know you’ve found them all?

How many different number bonds do you think there will be to make 10? Why?
Problem solving

Apply mathematics

Break down problems & persevere

Reasoning

Conjecture relationships & generalisations

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