

Maths Mastery at Isleham Primary School



Fluency,
Reasoning and
Problem Solving

*"The only way to learn
Mathematics is to do it."*



Outcomes for the session

- To remind you of the mastery approach to teaching Mathematics in the new curriculum.
- To focus on Fluency, Reasoning and Problem Solving.
- To take away ideas to support your child at home.



Mastery Curriculum

- Expectation that ALL children are capable of achieving high standards.
- Expectation that children will move through the curriculum at broadly the same pace.
 - Children assessed regularly to enable intervention to be targeted.
- Rapid grasp of concepts will be challenged to develop a deeper understanding rather than moving to the next years objectives.
- Those not fluent enough will consolidate understanding before moving on.

Basic



Deep



Mastery



Mastery Curriculum

- "Just getting the right answer in maths class isn't enough if students don't know why the answer is the right one."
- National Curriculum 2014



What is mastery in the primary classroom?

What is mastery?

A mathematical concept or skill has been mastered when a person can represent it in multiple ways, has the mathematical language to communicate related ideas, and can independently apply the concept to new problems in unfamiliar situations.

Mastery is a journey and long-term goal, achieved through exploration, clarification, practice and application over time.

Mastery may also be demonstrated through:

- ✓ Identifying which mathematical approach is most effective in different scenarios
- ✓ Combining different concepts to solve complex problems
- ✓ Ability to apply knowledge to real-life situations

Mastery Approach

- **Fluency:** the ability to recall and apply knowledge rapidly and accurately.
- **Reasoning:** explain their mathematical thinking.
- **Problem solving:** apply their knowledge to solve problems in varied contexts.



The National Curriculum for mathematics aims to ensure that all pupils:

- ❖ become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils have conceptual understanding and are able to recall and apply their knowledge rapidly and accurately to problems.



Fluency

- Quick recall of facts and procedures
- The flexibility and fluidity to understand the structure of maths
- The ability to recognise relationships and make connections in mathematics



Powerful questions to ask to support fluency (esp. in mental calculation!)

1. What do you notice? THINK before acting!
2. What's the same and what's different?
3. Can you do it another way?
4. What if...?
5. Can you find the mistake?
6. Does this answer look "reasonable"?
7. Is this true/false? How do you know?
8. What "models" would help you teach this to a younger child.
9. How could you prove it!



The National Curriculum for mathematics aims to ensure that all pupils:

- ❖ Reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language.
- ❖ *The ability to reason mathematically is THE most important factor in a pupil's success in mathematics.*



Why teach reasoning?

- Children need to be able to give a convincing argument that explains how or why a particular conclusion has been reached
- To become confident in mathematics they need to:
 - 'explain how you know'
 - 'explain why he/she is correct'
 - 'explain how this is possible'



Early Reasoning-based strategies

- Partitioning
- Near doubles
- Adjusting
- Scaling
- Known facts
- Estimating



Reasoning Prompts for Parents

- What can you work out (from the information)?
- If you know that, what else do you know?
- Can you tell me what your thinking is?
- Shall we test that?
- Does it work?
- Do you still think it is ... ?
- Do you agree that ... ?
- Why is that bit important?
- So, what must it be?



The National Curriculum for mathematics aims to ensure that all pupils:

- ❖ can solve problems by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.



3. Some children, who feel confident, will be let loose. They'll be able to explore deeper into the woods, before returning to the group to continue on with the journey.

2. Some children will need a little additional support along the way



4. Children will not be racing off ahead on a different journey.

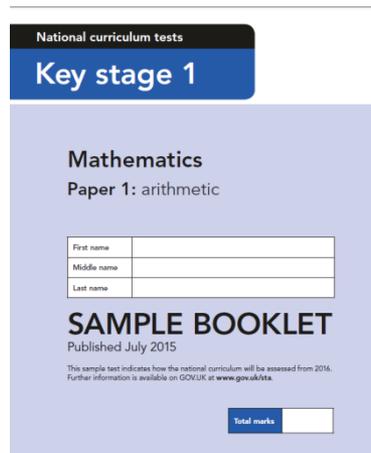
5. Children will not be left behind alone and isolated.

1. We ALL start the journey TOGETHER

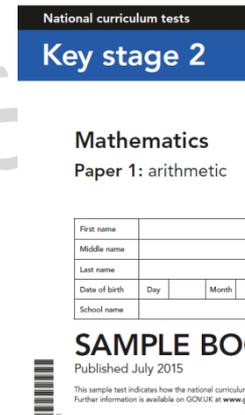
We're Going on a **Maths Hunt**



SATs Papers



- No equipment
- x1 arithmetic paper
 - 25 questions
 - No "formal" timing.
- x1 reasoning and problem solving paper
- No "formal" timing.



- No equipment
- x1 arithmetic paper
 - 36 questions in 30 mins
- No mental maths or calculator papers!
- x2 "reasoning and problem solving" papers - 40 mins each



Problem solving

Apply mathematics

Break down problems & persevere

Reasoning

Conjecture relationships & generalisations

Mathematical language

Fluency

Rapid & accurate recall

Conceptual understanding



Conceptual understanding



Bead strings

Dienes blocks



Fraction towers

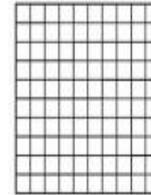
Cuisenaire rods



Multilink cubes



Bar models



100 grids

Number lines



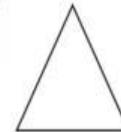
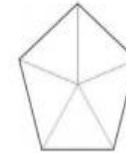
Conceptual understanding

Mathematical problem solving

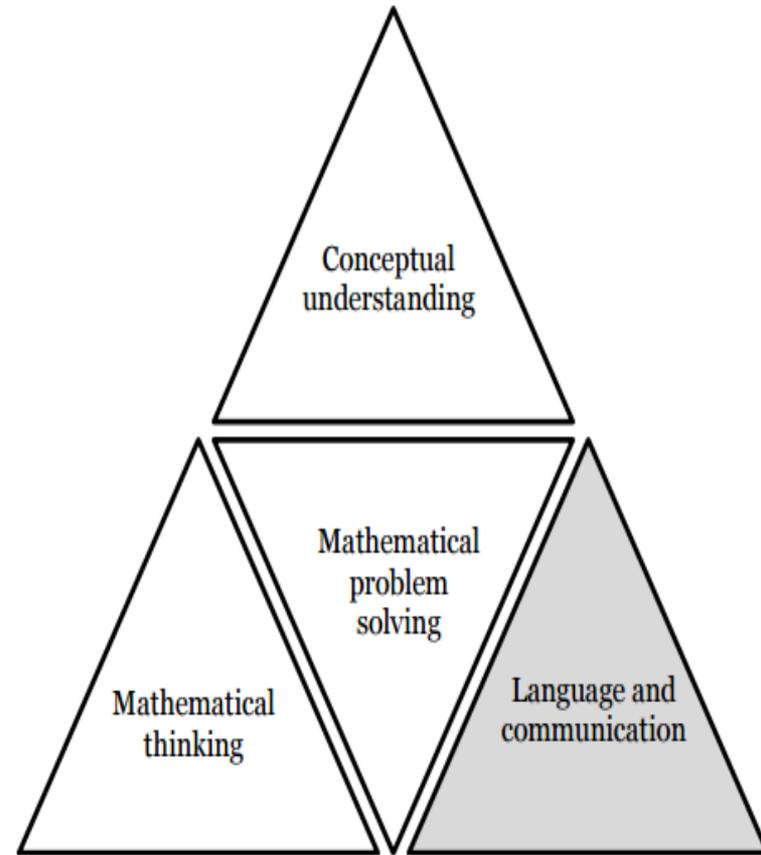
Mathematical thinking

Language and communication

Shapes



Mathematical language

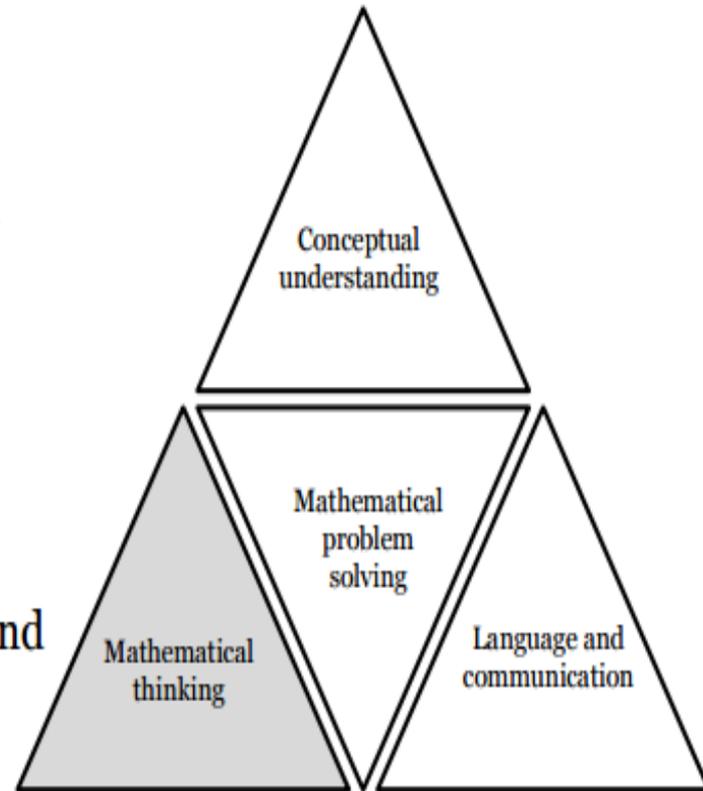


Mathematical thinking

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

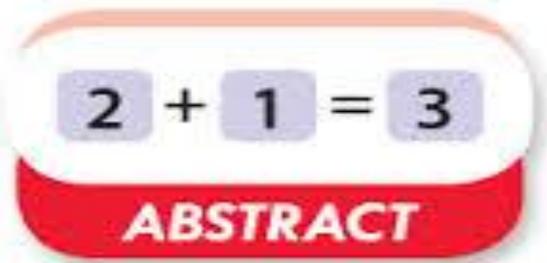
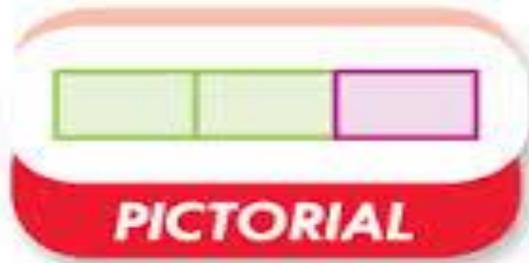
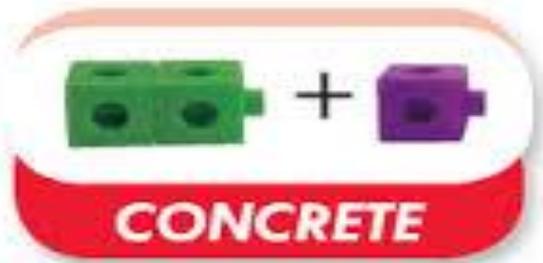
We believe that pupils should:

- 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**



Calculation: Beyond Counting

Perceptual Variation: "Seeing" in different ways.



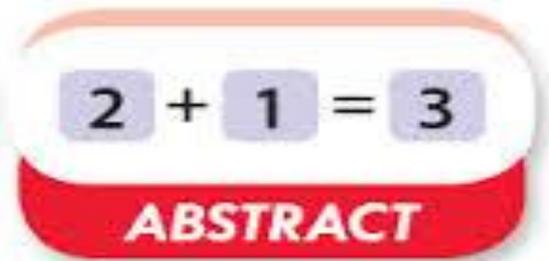
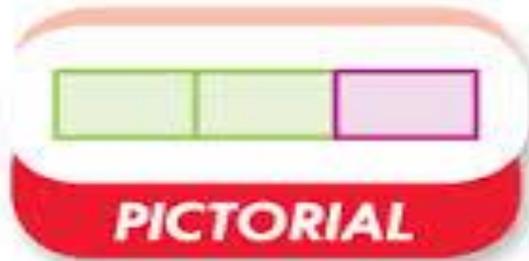
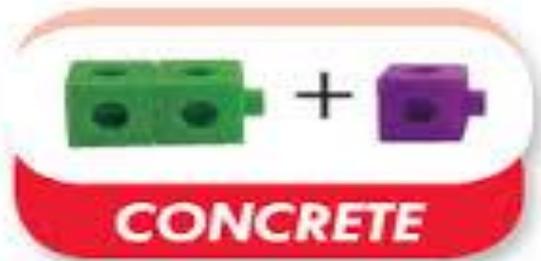
Supports:

- development of strong visual models
- finding models that work for each individual
- exploration of new ideas / concepts
- expression of ideas in convincing others



Calculation: Beyond Counting

Perceptual Variation: "Seeing" in different ways.



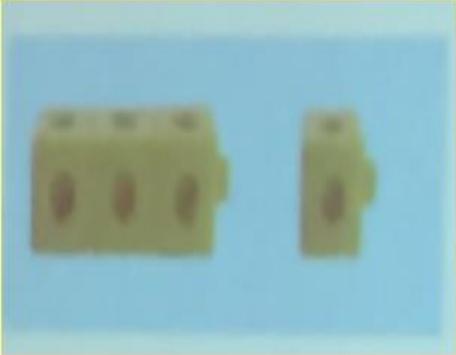
MYTHS!

"Good" mathematicians:

- don't use equipment to learn
- do it all in their heads
- are the fastest to the right answer
- are born that way!



Mastery: Concrete – Pictorial - Abstract



A photograph of three small, tan-colored toy figures standing on a light blue surface. To their right is a single, taller toy figure of the same color.



A horizontal bar divided into four equal segments. The first three segments are red, and the fourth segment is blue.

$$3 + 1 = 4$$

Concrete or pictorial representations support students to understand abstract concepts



Mastery: Concrete – Pictorial - Abstract

Bar Modelling - Ratio

Mr Fehr and Miss Franks share £10 in the ratio 2:3.
How much money do they get each?

Mr Fehr

£2 + £2 or $\text{£}2 \times 2 =$
£4



Miss Franks

£2 + £2 + £2 or $\text{£}2$
 $\times 3 = \text{£}6$

$$10 \div 5 = 2$$

The answer is only the beginning...

1) What is the answer?

2) Describe the procedure you used...

3) Why does the method work?

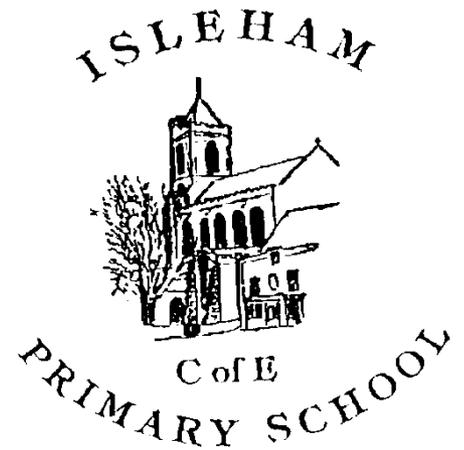
What relationships can you see?

What generalisations or rules can you make?



A mastery approach – our key principles...

- High expectations for ALL
- Concrete, pictorial, abstract
- Depth before breadth
- Fluency, Reasoning and Problem-solving
- Growth mindset
- Mathematical language



How can you help?

- Positive attitude to the maths learning.
- Use everyday opportunities to practise maths skills.
- Praise the process and not just a correct answer.
 - Find the logic in what they are saying!
 - No "wrong" strategy (if it gets the right answer!)
 - BUT some strategies more helpful than others!
- Use powerful questions when exploring maths problems.
- Praise deep thinking skills rather than speed.
- Embrace the mistakes!



What can you do at home?

- Number bonds to different amounts e.g. 10, 20, 50, 100.
- Using practical resources.
- Counting in different amounts e.g. 2s, 5s, 8s.
- Learning times tables- any order and division facts.
- Recognising coins, making different amounts and finding change.
- Looking at shapes in the real world and discussing properties.
- Cooking- weighing and measuring different ingredients.
- Relating time to daily routines and telling the time – analogue and digital.
- Sitting with your child each week whilst completing home work for discussion.



Make Maths fun at home!

- Measure ingredients when cooking.
- Count door numbers as you are walking along a street.
- Count as you go up/down stairs – count in 2s, 3s, 4s etc. It doesn't have to be 1 step!
- Set them open challenges, such as:
The answer is 18, what is the question?
- Solve missing number problems



Thank you for listening!

- Please go and find your children and let them show you the wonderful learning in our classrooms.



- Please fill in a speech bubble before you go home to let us know how you have found our workshop today... We really appreciate your support and feedback...

