Teaching for Mastery
Exploring teaching strategies
If China is the whole, then, Shanghai is a part of China.
If Europe is the whole,
Then, ... is a part of Europe.
If the journey from Jerry’s House to Danny’s House is the whole can you name a part of the journey.
Part and Whole

Identify a whole and a part of the whole and tell your partner

Say the sentence
If…….. is the whole, then ……..is part of

-------------
Wholes and parts

Your shape is the whole
Cut it into a maximum of 4 parts
Colour each part a different colour
Glue the parts together to return to the whole
Say: If .......... is the whole, then .......... is the part of the whole.
Say: If ....... is the whole, then ....... is the part of the whole.
The relationship between a whole and the parts.

A whole can be divided into many parts.

Many parts can make one whole.
Homework

Identify parts and wholes
Bring them back to share tomorrow
What’s the same, what’s different?

What features of the lesson are different to those taught in your school at the moment?
Teaching for Mastery
Exploring teaching strategies
Key Features of the lesson

• Repetition – providing a conceptual framework
• Conceptual variation – moving from one representation of the concept to another
• Simple but deep
• Small focus
Teaching strategies to support mastery

- Discussion – the answer is only the beginning
- Ping-Pong style – providing sufficient scaffold for all pupils to access
- Repetition and chorusing
- Precision in the use of mathematical language
- Carefully chosen examples and representations to draw out the essence of the concept (conceptual variation)
- Intelligent practice (often outside of the lesson)
- Dong Nao Ting
Ping Pong
Style of Teaching
Ping Pong

• Provides a clear and coherent journey through the mathematics
• Provides detail
• Provides scaffolding for all to achieve
• Provides the small steps
Letting go!
But then reining back in
Ping Pong and Discussion
Let Go

Methods for finding area

2. Find the area of the shape on the right.
Reining back in

Miho and her classmates are explaining their friends' ideas.

Hiroki

2 cm

2 cm

6 cm

A

3 cm

F

E

D

G

B

C

4 × 6 − 2 × 3 = 24 − 6

= 18

Answer: 18 cm²

Look at what Hiroki drew and write down his ideas using math sentences.

Takumi

Look at the math sentence Takumi wrote and explain how he thought about the problem.

Write down the lengths of the segments and draw in any additional segments in the figure above.

Providing Textbook Supports for Teaching Math Akihiko Takahashi
https://prezi.com/s1nvam1gllv9/providing-textbook-supports-for-teaching
Let go

Calculate the area of the shape below in many different ways.

Let's check.

Try different problems using what you've learned today.
Reining back in

We can calculate the area of shapes like rectangles and squares.

We need to use what we have learned so far, don’t we?

Providing Textbook Supports for Teaching Math Akihiko Takahashi
https://prezi.com/s1nvam1glv9/providing-textbook-supports-for-teaching-math/
Pupil Support

• One of the most important tasks of the teacher is to help his students...

• If he is left alone with his problem without any help or insufficient help, he may make no progress at all...

• If the teacher helps too much, nothing is left to the student

• (Polya 1957)
Repetition and Chorusing
The role of repetition

*I say, you say, you say, you say, we all say*

This technique enables the teacher to provide a sentence stem for children to communicate their ideas with mathematical precision and clarity. These sentence structures often express key conceptual ideas or generalities and provide a framework to embed conceptual knowledge and build understanding. For example:

*If the whole is divided into three equal parts, one part is one third of one third of the whole.*

Having modelled the sentence, the teacher then asks individual children to repeat this, before asking the whole class to chorus chant the sentence. This provides children with a valuable sentence for talking about fractions. Repeated use helps to embed key conceptual knowledge.

https://www.ncetm.org.uk/resources/48070
The whole is divided into (  ) equal parts, each part is (  ) of the whole.

What’s the Same What’s different?
An example of conceptual variation
Teaching with variation
Teaching with variation

- Conceptual Variation
- Procedural Variation
2. Use fractions to express the coloured parts.

A. Use fractions to express the coloured parts.

- The green part is the fraction \( \frac{1}{2} \) of the cube.
- The red part is the fraction \( \frac{1}{3} \) of the square.
- The pink part is the fraction \( \frac{1}{4} \) of the triangle.

B. The chocolate pieces are divided as follows:
- The boy received \( \frac{1}{2} \) of the pieces.
- The girl received \( \frac{1}{2} \) of the pieces.

The chocolate pieces are divided into equal parts for each child.
Reflection on Variation

• It is generally perceived as one of the most valuable experiences within Chinese mathematics education community (e.g. Sun, 2011).

• Gu, Huang, & Marton (2004) argued that, by adopting teaching with variation, even with large classes, students still could actively involve themselves in the process of learning.
Purpose of Variation

• Develop deep learning rather than superficial learning

• Provide the necessary repetition to embed and sustain learning

• Make connections between ideas
Consider how variation can both narrow and broaden the focus
Taken from Mike Askew, Transforming Primary Mathematics, Chapter 6
The child is carrying out the procedural operation of multiplication, but through connected calculations has the opportunity to think about key concepts involving multiplication and place value.

This leads to intelligent practice.

<table>
<thead>
<tr>
<th>2 × 3 =</th>
<th>6 × 7 =</th>
<th>9 × 8 =</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 × 30 =</td>
<td>6 × 70 =</td>
<td>9 × 80 =</td>
</tr>
<tr>
<td>2 × 300 =</td>
<td>6 × 700 =</td>
<td>9 × 800 =</td>
</tr>
<tr>
<td>20 × 3 =</td>
<td>60 × 7 =</td>
<td>90 × 8 =</td>
</tr>
<tr>
<td>200 × 3 =</td>
<td>600 × 7 =</td>
<td>900 × 8 =</td>
</tr>
</tbody>
</table>
7 + 2 =  9 + 6 =  
17 + 2 = 10 + 6 =  
7 + 12 = 11 + 6 =  
17 + 12 = 13 + 6 =  

9 − 5 =  9 − 7 =  
8 − 5 = 11 − 7 =  
7 − 5 = 13 − 7 =  
6 − 5 = 15 − 7 =  

9 × 50 〇 90 × 5  
300 × 3 〇 5 × 200  

18 − □ = 8  20 − □ = 16  
18 − □ = 10  18 − □ = 10  
18 − □ = 12  16 − □ = 12  
18 − □ = 14  14 − □ = 6  
18 − □ = 16  12 − □ = 8  

907 − 100 = 807  
907 − 99 = __  
907 − 101 = __  

888 − 99 = ____  
888 − 100 = ____  
888 − 101 = ____  

75 + _____ = 100  
56 + _____ = 100
Dong Nao Jin
How to illustrate these fractions on the diagram.

\[
\frac{2}{3} \quad \frac{1}{4} \quad \frac{4}{9} \quad \frac{2}{3}
\]
动脑筋 (dong nao jin)

A regular part of a lesson
In general, this part is not from the textbook.
Sometimes it is:
• A challenging question for students,
• A “trap” for students.
• Very “tricky” which may let the students “puzzle” again
• It is an opportunity help student think about the knowledge in another way.
There are two parallelograms, the areas are same or not?
Can you draw other parallelograms which have the same area?
(Let the students pay attention to the bottom and height, it is the key point of the whole lesson.)
Implications for leaders of MathsHUBS mathematics

• Be brave but not reckless
• Use your professional judgement
• Gather the evidence
• Lead by example
• Be clear what you are doing and why you are doing it.
• Use each other – support and share
Planning for Mastery
Implementation – Where do we start?

• Total emersion across the school
• Starting with one class/year group
• Implementing aspects across the school
• Closing the gap strategies
• Pre teaching

For those of you who have begun, please share strategies
Mixed Aged Classes

What particular challenges do these pose?

Two Potential Models:
• Teach two 35min maths lessons per day
• Teach the class together to begin with then extend and support through guided group work.
Support and Resources

• NCETM/Maths Hubs Assessment Resources
• Progression Maps with Reasoning
• National Curriculum Resource Tool
• Conceptual Coherence Progression Maps
• Textbooks- OUP Inspire Maths; MNP Maths No Problem
• Collins Practice Books
• Kangaroo Maths
• White Rose – Progression Maps
Same Day Intervention

This might take place:
During practice time
During another lesson
Outside of lesson time

You need to decide what works best in your school
Planning

- Spend longer time on topics
- Prioritise key topics
- Focus on relationships
- Make Connections
- Ensure intelligent practice
## Longer Time on Topics

### Curriculum Planning

#### School Curriculum Map

<table>
<thead>
<tr>
<th>Term 1</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number and Place Value</td>
<td>Number and Place Value</td>
<td>Number and Place Value</td>
<td>Number and Place Value</td>
<td>Number and Place Value</td>
<td>Number and Place Value</td>
</tr>
<tr>
<td>Addition and Subtraction</td>
<td>Addition and Subtraction</td>
<td>Addition and Subtraction</td>
<td>Addition and Subtraction</td>
<td>Addition and Subtraction</td>
<td>Addition and Subtraction</td>
</tr>
<tr>
<td>Multiplication and Division</td>
<td>Multiplication and Division</td>
<td>Multiplication and Division</td>
<td>Multiplication and Division</td>
<td>Multiplication and Division</td>
<td>Multiplication and Division</td>
</tr>
<tr>
<td>Geometry</td>
<td>Geometry</td>
<td>Geometry</td>
<td>Ratio</td>
<td>Ratio</td>
<td>Ratio</td>
</tr>
<tr>
<td>Statistics</td>
<td>Algebra</td>
<td>Algebra</td>
<td>Algebra</td>
<td>Algebra</td>
<td>Algebra</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Term 2</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number and Place Value</td>
<td>Number and Place Value</td>
<td>Number and Place Value</td>
<td>Number and Place Value</td>
<td>Number and Place Value</td>
<td>Number and Place Value</td>
</tr>
<tr>
<td>Addition and Subtraction</td>
<td>Addition and Subtraction</td>
<td>Addition and Subtraction</td>
<td>Addition and Subtraction</td>
<td>Addition and Subtraction</td>
<td>Addition and Subtraction</td>
</tr>
<tr>
<td>Fractions</td>
<td>Fractions</td>
<td>Fractions</td>
<td>Fractions</td>
<td>Fractions</td>
<td>Fractions</td>
</tr>
<tr>
<td>Ratio</td>
<td>Ratio</td>
<td>Ratio</td>
<td>Algebra</td>
<td>Algebra</td>
<td>Algebra</td>
</tr>
<tr>
<td>Measurement</td>
<td>Measurement</td>
<td>Measurement</td>
<td>Measurement</td>
<td>Measurement</td>
<td>Measurement</td>
</tr>
<tr>
<td>Geometry</td>
<td>Geometry</td>
<td>Geometry</td>
<td>Geometry</td>
<td>Geometry</td>
<td>Geometry</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Term 3</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number and Place Value</td>
<td>Number and Place Value</td>
<td>Number and Place Value</td>
<td>Number and Place Value</td>
<td>Number and Place Value</td>
<td>Number and Place Value</td>
</tr>
<tr>
<td>Addition and Subtraction</td>
<td>4 operations</td>
<td>Multiplication and Division</td>
<td>Multiplication and Division</td>
<td>Multiplication and Division</td>
<td>Multiplication and Division</td>
</tr>
<tr>
<td>Fractions</td>
<td>Fractions</td>
<td>Fractions</td>
<td>Fractions</td>
<td>Fractions</td>
<td>Fractions</td>
</tr>
<tr>
<td>Ratio</td>
<td>Ratio</td>
<td>Ratio</td>
<td>Ratio and Scaling</td>
<td>Ratio and Scaling</td>
<td>Ratio and Scaling</td>
</tr>
<tr>
<td>Algebra</td>
<td>Algebra</td>
<td>Algebra</td>
<td>Algebra</td>
<td>Algebra</td>
<td>Algebra</td>
</tr>
<tr>
<td>Measurement</td>
<td>Measurement</td>
<td>Measurement</td>
<td>Statistics</td>
<td>Statistics</td>
<td>Statistics</td>
</tr>
<tr>
<td>Geometry</td>
<td>Statistics</td>
<td>Statistics</td>
<td>Statistics</td>
<td>Statistics</td>
<td>Statistics</td>
</tr>
</tbody>
</table>
Ofsted

• Produce a clear outline of:
• What you are doing
• Why you are doing it
• What it looks like in practice