Mastery approach for Maths

Parent information Session

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Mastery Content

- Maths results falling behind the rest of the world
- Less students wanting to study at higher levels.
- Industry informing the government that school leavers levels of arithmetic/ problem solving are poor.
- The DfE looked to the top performing nations in the world for inspiration.

Singapore Education

Singapore hasn't always had great Maths performance.

It was ranked 16th out of the 20 countries participating in the 1983 SIS study.

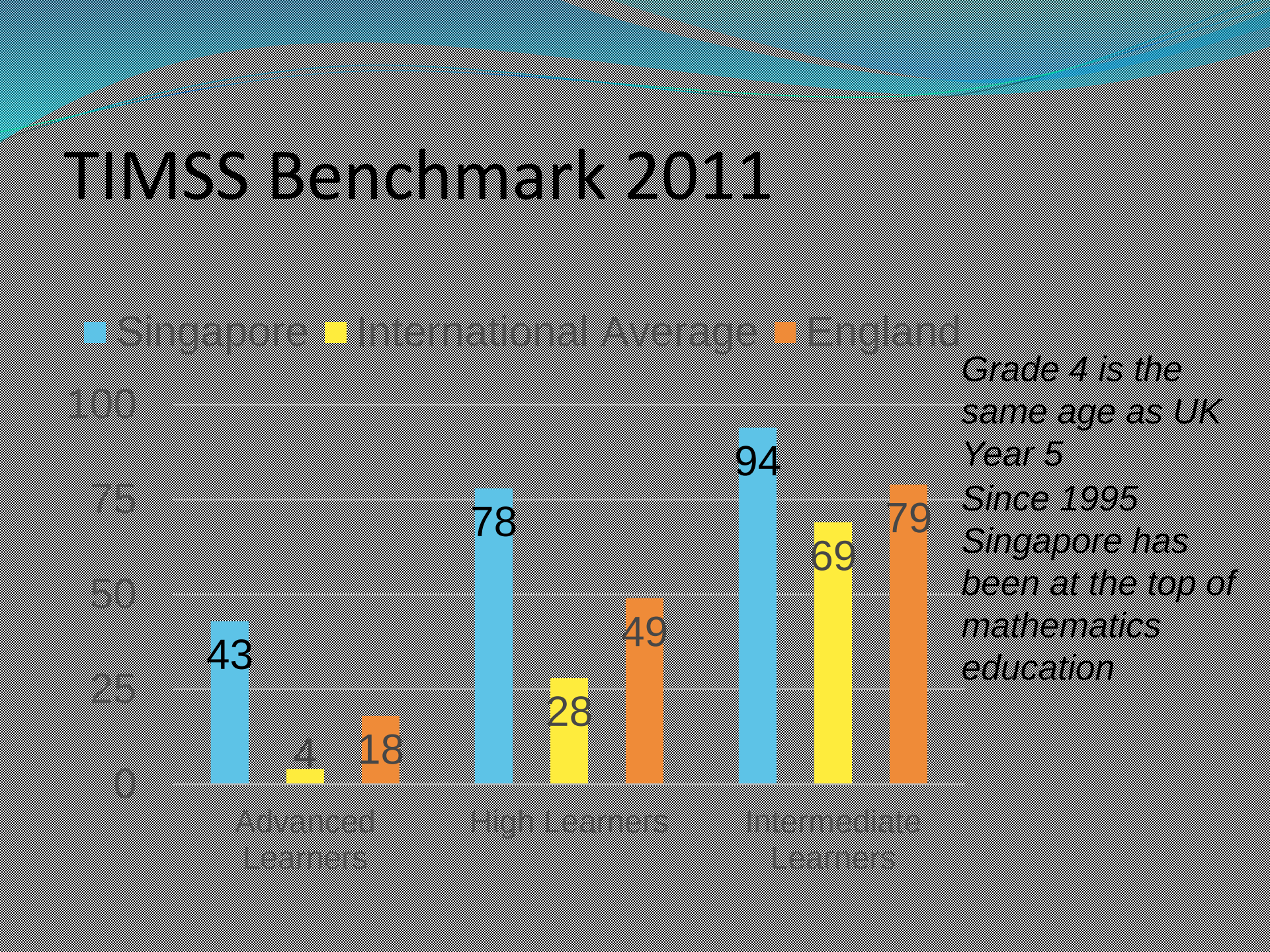
The government recognised this was not good enough for an economy entirely dependent on its human resources, so they started examining leading teaching concepts in the early 1980s.

Setting Set

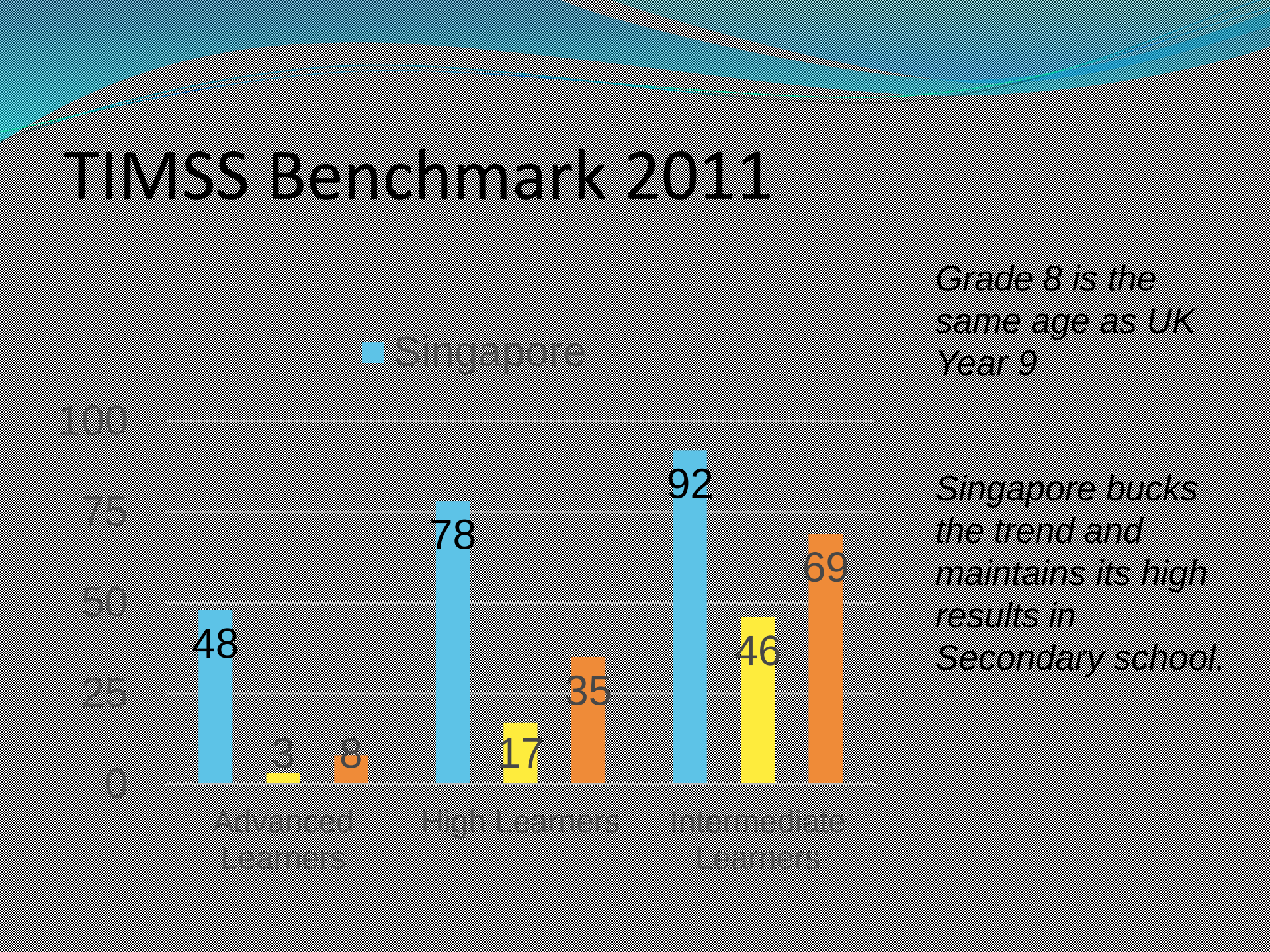
- With an economy completely reliant upon the ability of its human resources, Singapore overhauled its Maths teaching system, drawing from best practice elsewhere in the world.
- The UK's Cockroft report and a similar study in the US had a fundamental influence. Both studies concluded that:

1. Problem solving is at the heart of Mathematics and should be the focus of what is taught in schools
2. Basic skills in Mathematics should be defined to encompass more than computational facility

TIMSS Benchmark 2011



TIMSS Benchmark 2011



Mastery

- fosters mathematical understanding of new concepts and methods, including teachers' explanations and the way they require pupils to **think and reason mathematically for themselves**
- ensures that pupils acquire mathematical knowledge appropriate to their age and starting points, and enables them to **recall it rapidly and apply it fluently and accurately**
- uses **resources and approaches to enable pupils in the class to understand and master** the mathematics they are learning. The National Curriculum for Mathematics specifies the aims and then states: **'The expectation is that the majority of pupils will move through the programmes of study at the same pace.'**
- develops depth of understanding and readiness for 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, before moving on.
- enables pupils to solve a variety of mathematical problems **applying the mathematical knowledge and skills** they have been taught.

Working with pupils core competencies

Problem solving is at the heart of mathematics

The focus is not on rote procedures, rote memorisation or tedious calculation but on relational understanding.

Pupils are encouraged to solve problems working with their core competencies, in particular

1. *Visualisation*
2. *Generalisation*
3. *Make decisions*

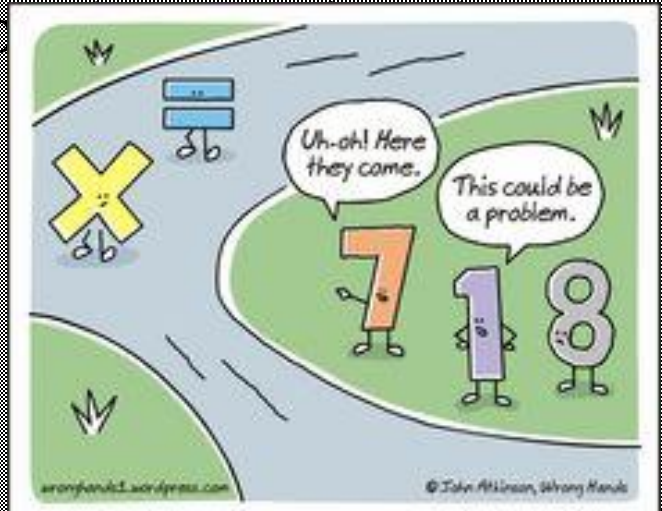
Mastery

What does "mastery" mean?

- I know how to do it.
- It becomes automatic and I don't need to think about it.
- I do it confidently.
- I do it well. (Does "well" mean "quickly"? Sometimes?)
- I can do it in a new way, or in a new situation.
- I can now do it better than I used to.
- I can show someone else how to do it.
- I can explain to someone else how to do it.

Fluency involves:

- Quick recall of facts and procedures
- The flexibility and fluidity to move between different contexts and representations of mathematics.
- The ability to recognise relatic connections in mathematics



FLEY

Number bonds

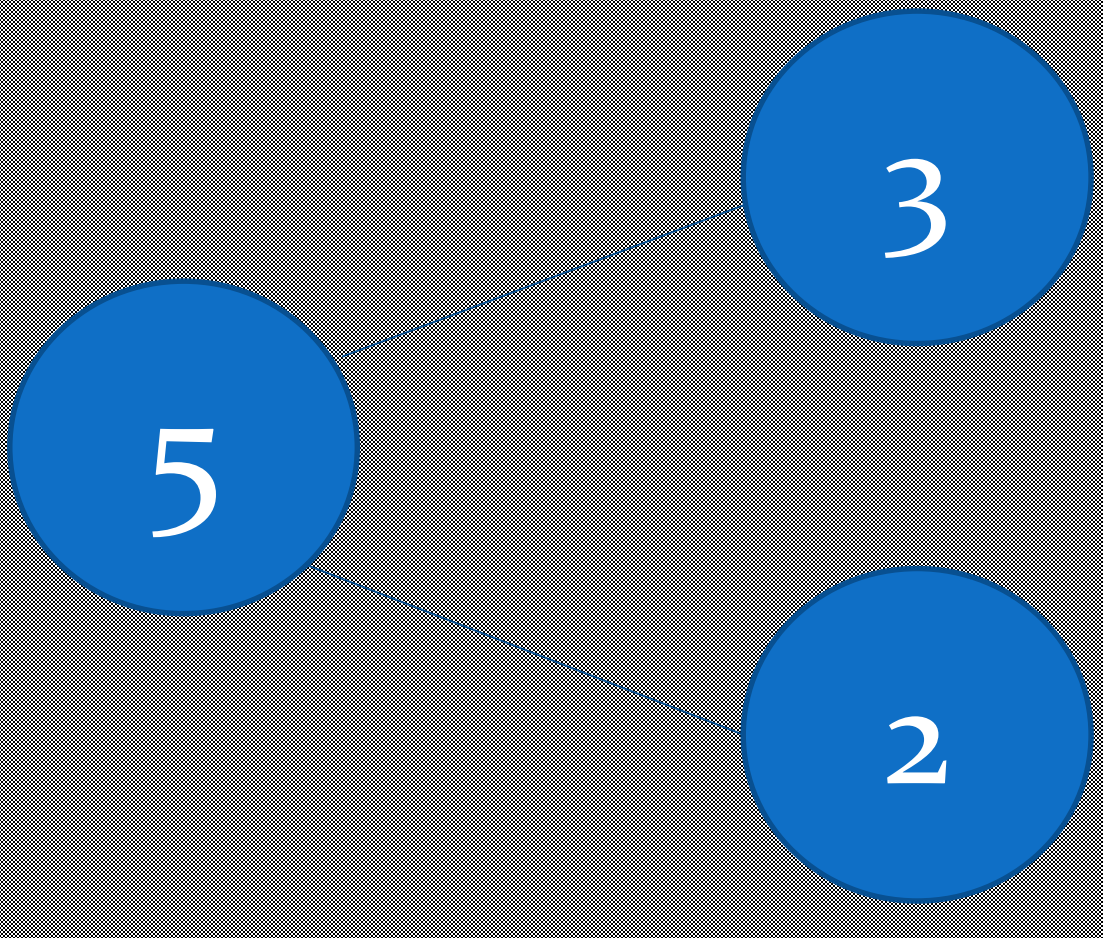
Times tables

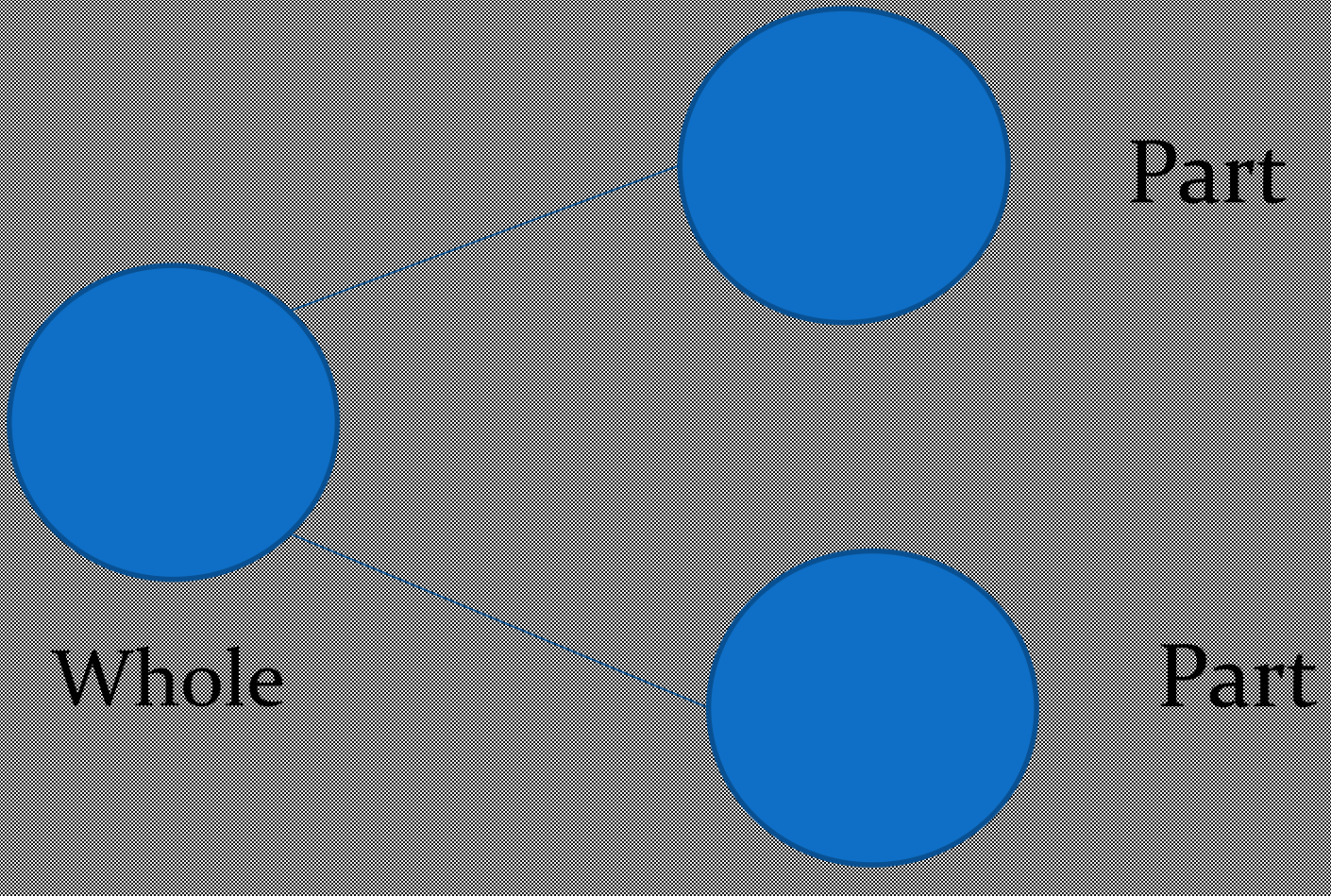
Inverse relationships etc.

Numbers

- A lot of emphasis is put on number bonds and in particular a recognition that numbers can be split up and put together in different ways.
- This formulates a basis for number sense which is applied as a platform for decision making.
- The number bond diagram is consistently used as a visual way of showing how numbers can be split into their component parts, often as a means of describing what the children are thinking.

Use of number bonds and the number bond diagram




Part
Whole
Part

how lessons start

- Concepts merge into each other.
- Lessons are typically broken into 3 parts and can last one or more days.
- Children master topics before moving on.

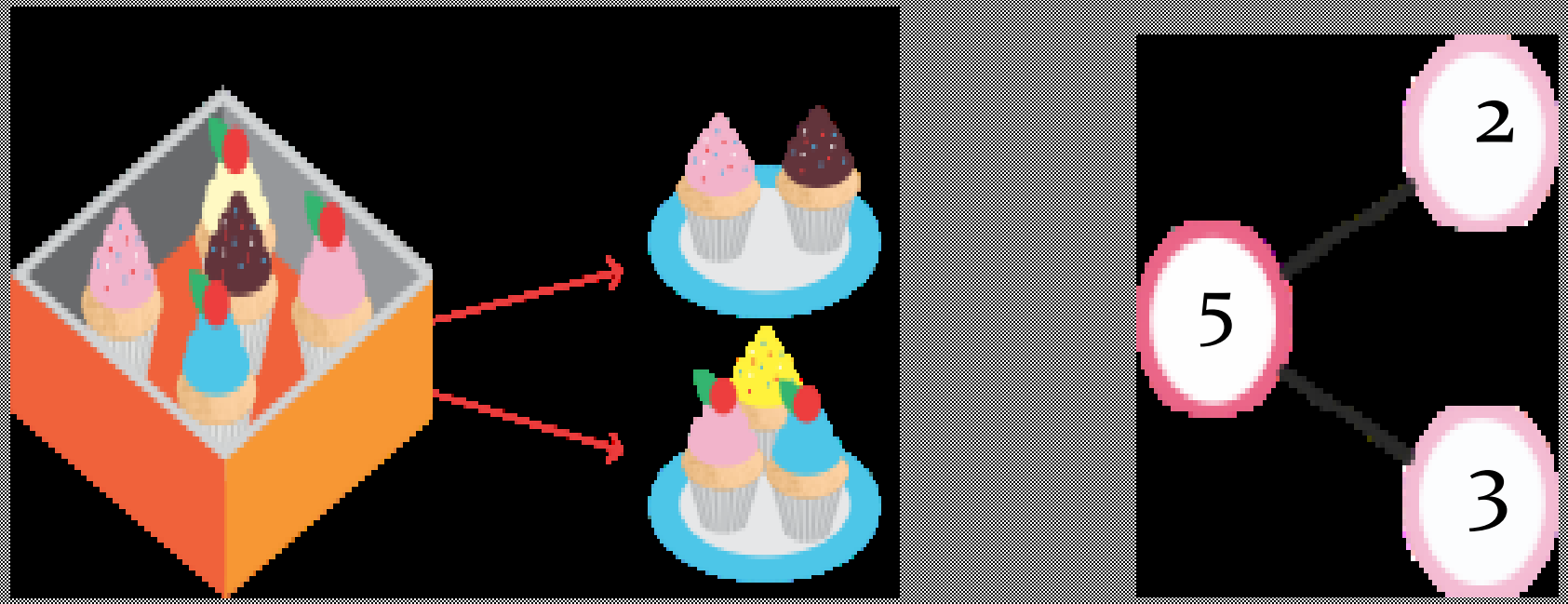
Activities

- Anchor task – the entire class spends a long time on one question guided by the teacher.
- Guided practice – practice new ideas in groups guided by the teacher
- Independent practice

Anchor task

How many cakes are there on each plate?

Is there another way to put the cakes on each plate?


2
5
3

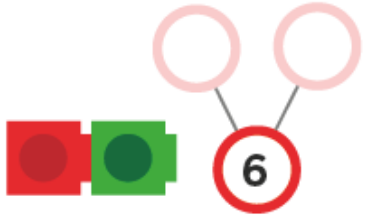
Activity Time

Work in groups of 4.

1. Make number bonds of 6.
2. Put  on the 

to show different ways to make 6.
3. Take turns to make number bonds for different numbers.

What you need:



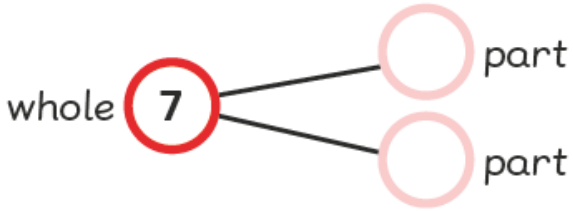
How many number bonds can you make?

Guided practice

Complete the number bonds.

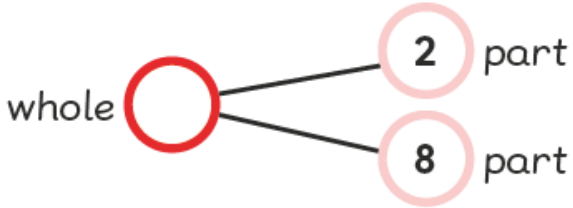
(a)

 and make 7.



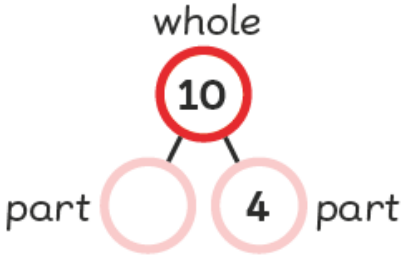
(b)

2 and 8 make  .



(c)

4 and  make 10.



Mastery

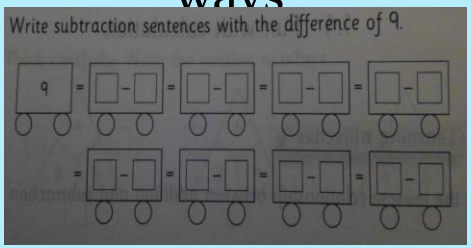
- Concepts will be fully developed before moving on. Children will have had plenty of practice to embed ideas.
- Lots of time to help those who are being challenged as well as allowing advanced learners time to deepen their understanding.

Approach

- Concrete: based on hands-on sensory experiences of physical objects together with the consequences that go after.
- Pictorial: Knowledge can be represented using models and pictures. Learners know how to make mental images of their world.
- Abstract: Learners can think in abstract. Abstract terms and symbol systems can be used to represent knowledge like numbers, mathematical symbols, letters and language.

Differentiating through depth for highest attainers – some ideas!*

Many different ways

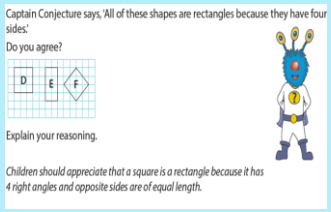


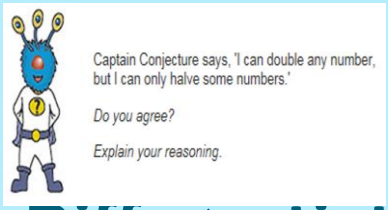
6 + 8 = 14

Find 3 different ways to solve this.

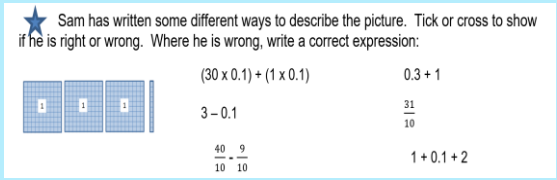
[Where relevant, would expect systematic working from highest attainers]

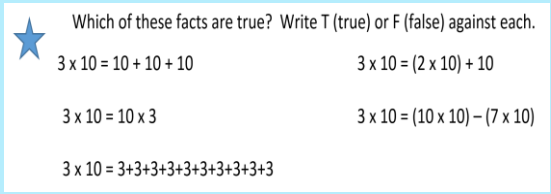
Generalising



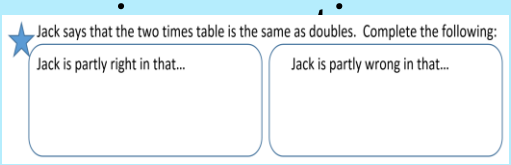


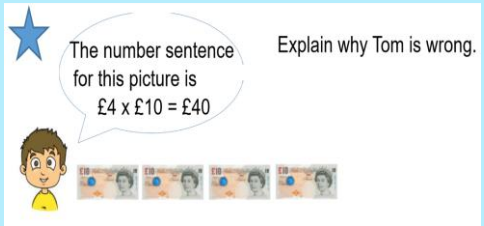
Equivalent or not?



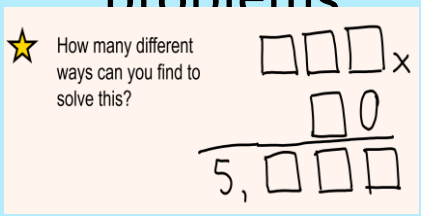


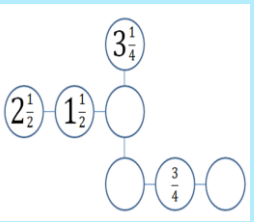
Explaining ideas/

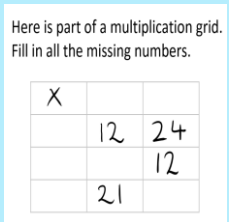




Empty box problems

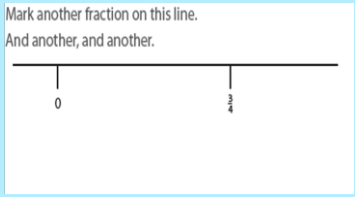


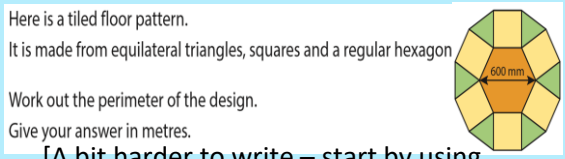




These are not the only ways! Just some of my 'go to' ones

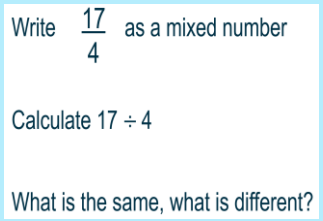
No clear signpost

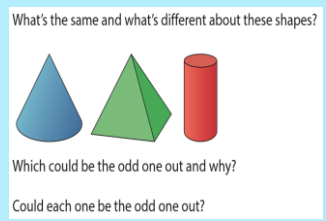




[A bit harder to write – start by using e.gs in NCETM assessing for mastery materials]

What is the same, what is different?





Features of lesson

- Whole class work together
- Journey taken – small step
- Teacher led
- Ping pong teaching
- Children will speak in full sentences
- Accurate use of mathematical knowledge language
- Repetition (of each other and of the teacher)
- Build on each others ideas (differentiation by questioning)
- Intelligent practice
- Independent practice

Year 2 - compare and order numbers from 0 up to 100; ordering

Hungry Alligators Love to Eat the Biggest Number!

1)	91		27	9)	49		53
2)	83		65	10)	75		49
3)	57		59	11)	57		70
4)	69		72	12)	47		45
5)	22		11	13)	47		43
6)	36		25	14)	47		31
7)	38		20	15)	39		37
8)	36		53	16)	23		70

Use < > or = in each circle, fill in the missing boxes with numbers

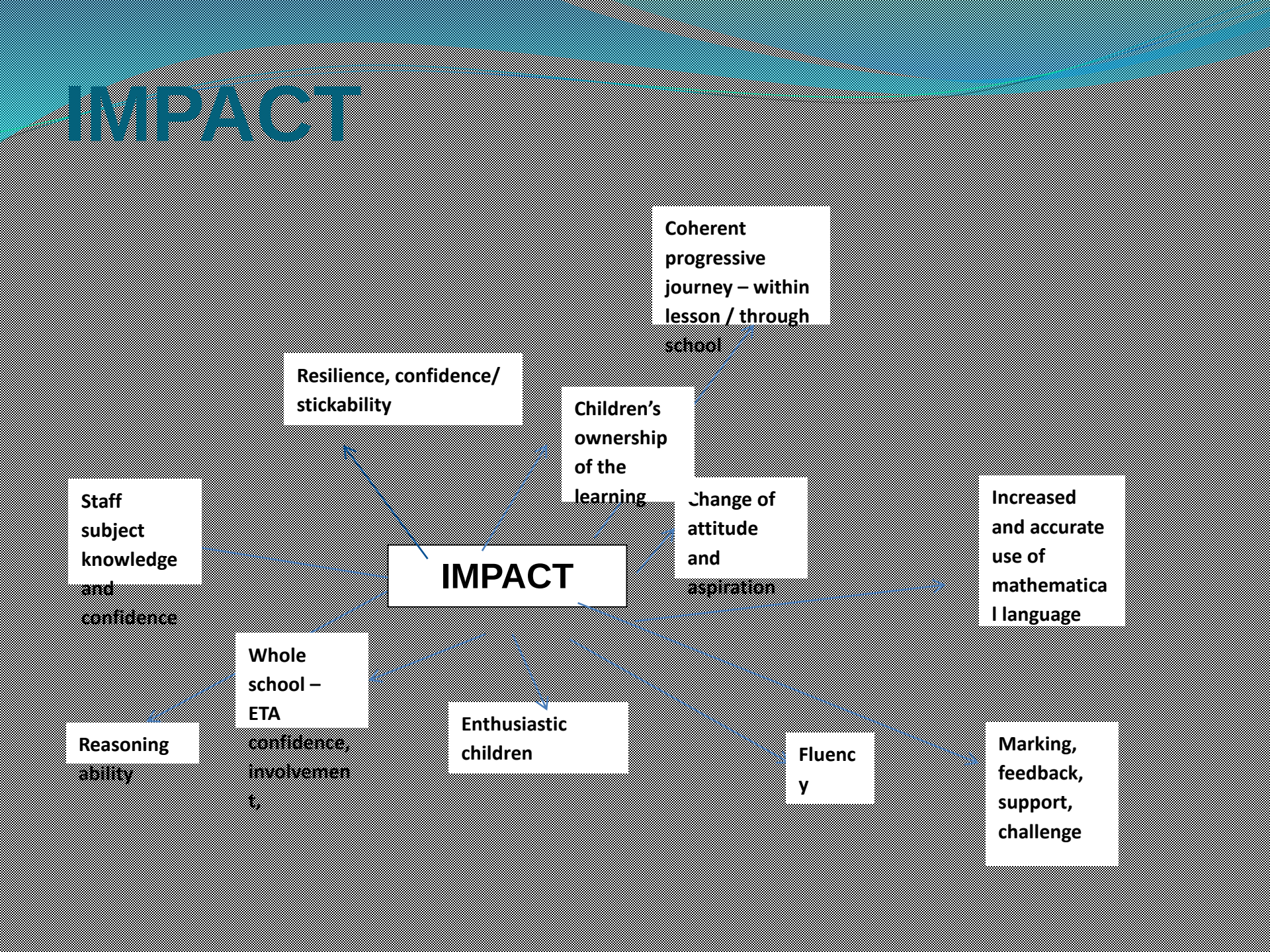
1) 2 ○ 8 2) 6 ○ 1 3) 8 > □

4) □ < 4 + 2 5) 1 + 3 ○ 4

6) 5 + 2 ○ 8 − 3 7) 9 − 5 ○ 6 − 3

8) □ − 2 > 8 + □ 9) □ + □ < □ − □

IMPACT


Coherent progressive journey – within lesson / through school
Resilience, confidence/ stickability
Children's ownership of the learning
Staff subject knowledge and confidence
Change of attitude and aspiration
Increased and accurate use of mathematical language
IMPACT
Whole school – ETA
Reasoning ability
Confidence, involvement
Enthusiastic children
Fluency
Marking, feedback, support, challenge

Final thoughts

It has become acceptable in society to be 'bad at maths'. Children are exposed to these messages constantly, and we need to actively find ways to encourage a positive, growth mindset to maths.

"In a growth mindset, people believe that their most basic abilities can be developed through dedication and hard work—brains and talent are just the starting point. This view creates a love of learning and a resilience that is essential for great accomplishment" Carol Dweck