# An introduction to Maths No Problem

2019

# Aims of the session

▶ What is Singapore maths?

▶ Importance of concrete equipment and visual models:

  ▶ Dienes, cubes, base 10 blocks

  ▶ Number bonds models

  ▶ Bar modelling

▶ What does a typical lesson look like?

▶ Impacts

▶ How to help at home

▶ Questions

# What is Singapore maths?

## Singapore Education

Singapore hasn't always had great Maths performance.

It was ranked 16th out of the 26 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.
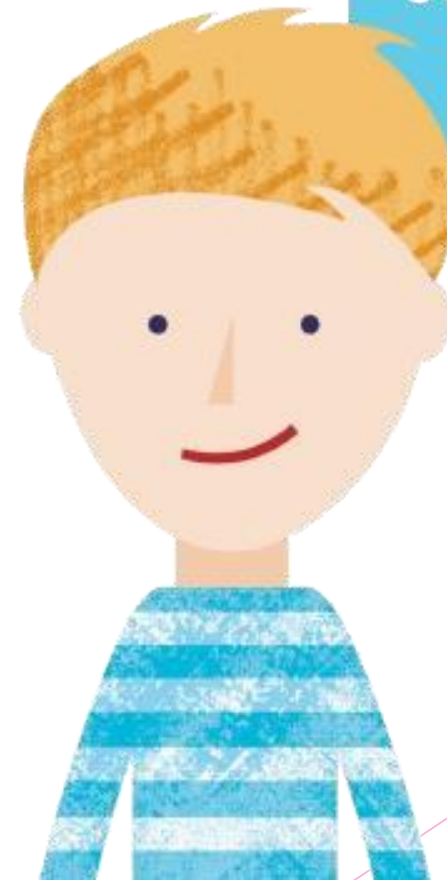
Setting the scene

# What is Singapore maths?

## Singapore Education

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.
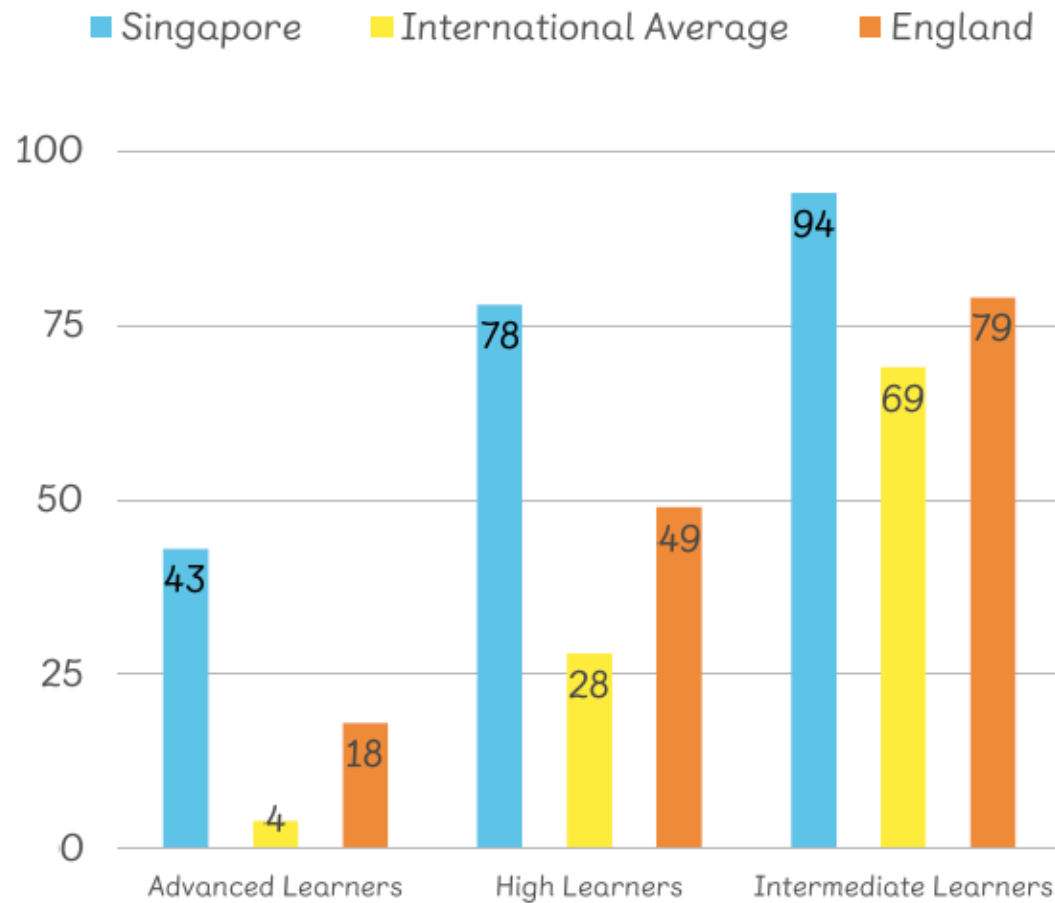
The UK's Cockroft report and a similar study in the US had a fundamental influence. Both studies concluded that:

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

# What is Singapore maths?

## TIMSS Benchmark 2011



Legend: ■ Singapore ■ International Average ■ England

| Learner Category | Singapore | International Average | England |
| --- | --- | --- | --- |
| Advanced Learners | 43 | 4 | 18 |
| High Learners | 78 | 28 | 49 |
| Intermediate Learners | 94 | 69 | 79 |

Grade 4 is the same age as UK Year 5

Since 1995 Singapore has been at the top of mathematics education

**MATHS NO PROBLEM!**

# Why use an approach based on Singapore Maths?

▶ New way of teaching maths following poor performance in international league tables in early 1980's.

▶ Singapore Ministry of Education took best practice research from the West and applied it to the classroom.

▶ Based on studies by Bruner, Skemp, Piaget, Vygotsky, and Deines.

▶ Highly-effective programme of teaching methods and resources.

▶ Top of the international benchmarks

▶ Using questioning and explorational learning

▶ Programme now used in over 40 countries including the United Kingdom and the United States

# National Curriculum 2014

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 develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately

▶ **reason** mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language

▶ 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.

# Singapore Maths at Westfield.

- Aim to have 100% of children achieving "expected" standard at KS2.

- Develops all abilities and stretches higher attainers' reasoning skills in line with new style SAT's.

- Researched and tracked its success in other schools over 18 months.

- £20 000 investment: materials, training, text books, work books and assessment tools.

- Allows all children to access the "productive struggle" phase.

- Journaling develops reasoning skills and ability to articulate in words, pictures and examples.

# Importance of resources



**Teaching Styles and Progression**
- ▶ **Concrete** (enactive/hands on)
- ▶ **Pictorial** (Iconic/models and pictures)
- ▶ **Abstract** (symbolic/symbols and numbers)

We might not realise what an incredible leap it is to see the symbol "6" and know that it relates to a number, e.g. pencils, that are sitting in front of us!

# Importance of resources
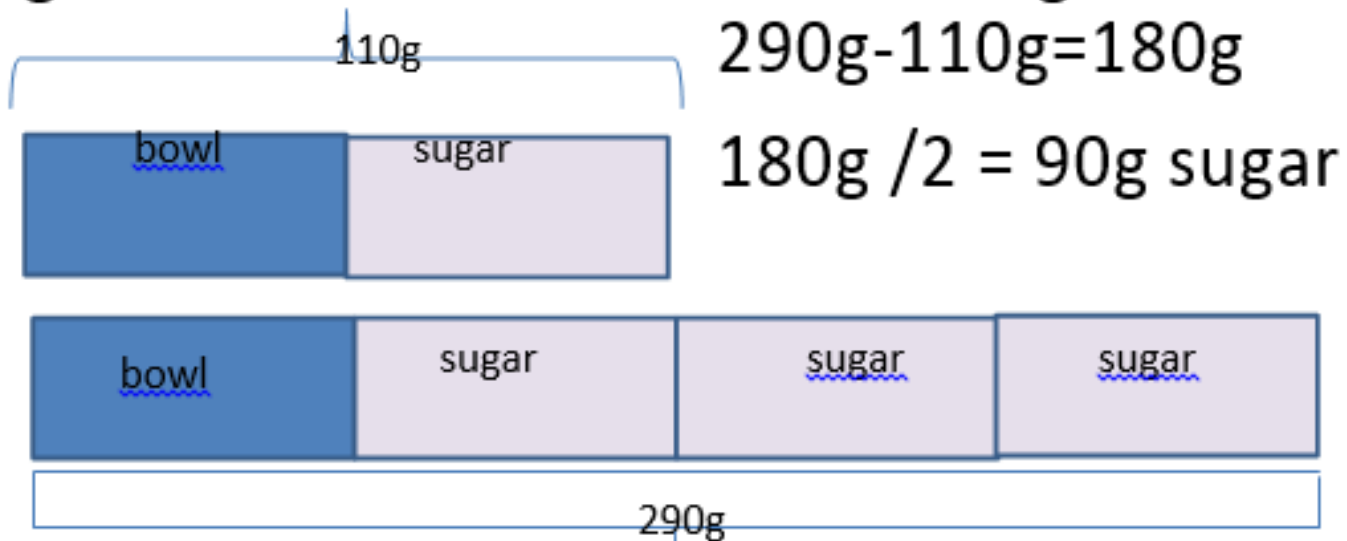
## Bar Model

Solve using the bar model

Tim has a bowl and some sugar. Together they weigh 110 grams. Sue empties the bowl and puts in three times the amount of sugar.
It now weighs 290 grams.

How much does the bowl weigh?

# Importance of resources

## Use of Bar Model

Sam has a bowl of sugar, the bowl and the sugar together weigh 110g. Alex pours the sugar out and then add three times more sugar than Sam had. Her bowl now weighs 290g. How much does the bowl weigh?

110g

290g-110g=180g

| bowl | sugar |
|------|-------|

180g /2 = 90g sugar

| bowl | sugar | sugar | sugar |
|------|-------|-------|-------|

290g

# How is a typical lesson structured?

A 'Ping Pong' approach to deepen reasoning is adopted:

▶ In Focus anchor task: problem

▶ Let's learn: solutions

▶ Guided practice: solving in pairs; using equipment; exploring and investigating.

▶ Journaling

▶ Independent workbook task

▶ Checking answers

▶ Working wall

# What does a typical lesson look like?

So let's see what a typical year 4 lesson looked like...this was delivered just 2 weeks ago.



Turn to ... Chapter 2, pg 62
Let's look at this problem:

In Focus

Scoreboard

| Name | Level | Score |
| --- | --- | --- |
| Hannah | 4 | 3041 |

I need to get 9 more points to get to Level 5.

How many points does [Hannah] need to get to the next level?

Are the methods we have been using to add appropriate for this problem? Why? Why not?
What methods are you already using to add 9? 99? 298?

## We are learning to...

To be able to add using mental strategies

## To be successful...

1. I can use my number bonds to 10 and 100.
2. I can recognise when I need to make 10 or 100
3. I can make links between numbers
4. I can explain the logic behind these mental calculations.

To be able to add using mental strategies.

1. I can use my number bonds to 10 and 100.
2. I can recognise when I need to make 10 or 100
3. I can make links between numbers
4. I can explain the logic behind these mental calculations.

## Let's Learn

Calculate mentally.

**1** Add 9 to 3041.

$$3041 + 9 = \boxed{\phantom{3050}}$$

make 10

$$3041 + 9 = 3040 + 10$$

$$3041 + 9 = 3050$$

needs 3050 points to get to the next level.

This is where your number bonds come in really useful!

What are your number bonds to 10?

3. I can make links between numbers
4. I can explain the logic behind these mental calculations.

strategies.

**Let's Learn**

Calculate mentally.

**1** Add 9 to 3041.

$$3041 + 9 = \boxed{\phantom{3050}}$$

make 10

$$3041 + 9 = 3040 + 10$$

$$3041 + 9 = 3050$$

needs 3050 points to get to the next level.

Let's do some of these together - look at the step by step! Then it'll be your turn on your boards.

Try **mentally**:

a) 2083 + 7 = _2090_

b) 6234 + 6 = _6240_

c) 1035 + 5 = _1040_

d) 4629 + 1 = _4630_

e) 3548 + _2_ = 3550

f) _7_ + 4453 = 4460

g) 4502 + _8_ = 4510

h) _10_ + 1530 = 1540

It is much easier to add when you can make 10!

What do we add to these numbers to get to the next 10?

21 + ▮ = 30

32 + ▮ = 40

156 + ▮ = ▭

199 + ▮ = ▭

1999 + ▮ = ▭

Developing vocabulary e.g the next 10

What about these? What can we add to get to the nearest 10?

389 + ▮ = ▭

408 + ▮ = ▭

631 + ▮ = ▭

842 + ▮ = ▭

1243 + ▮ = ▭

2381 + ▮ = ▭

# What about using this skill to help us with our addition?

What do we know about 19 and the next 10?

1~~2~~ + 19 = ▮▮▮ = ▮

Take one from 12 and add to 19 to get our next 10 to reach 20.

$199 + 24 = 200 + 23 = 223$

8 + 17 = ▮▮▮ = ▮

$199 + 24 = 200 + 23 = 223$

$298 + 154 = \square + \square = \square$

$1298 + 142 = \square + \square = \square$

To be able to add using mental strategies.

**Let's Learn**

**2** Find the sum of 98 and 4142 by adding mentally.

$$98 + 4142 = \boxed{\phantom{0000}}$$

make 100

$$98 + 4142 = 100 + 4140$$

$$= 4240$$

This is also where your number bonds come in really useful!

To be able to add using mental strategies.

1. I can use my number bonds to 10 and 100.
2. I can recognise when I need to make 10 or 100
3. I can make links between numbers
4. I can explain the logic behind these mental calculations.

**Let's Learn**

3

£1999

£299

Find the total price by adding mentally.

$$1999 + 299 = 2000 + 298$$
$$make\ 2000 = 2298$$

The total price is £2298.

Is there another way?
2000 + 300 = 2300

Would it make sense here to make 10 or 100? Why?
Could there be anything else that would be more useful? 1000's perhaps?

I know this because...

Where else might this type of calculation come in useful?

To be able to add using mental strategies.

1. I can use my number bonds to 10 and 100.
2. I can recognise when I need to make 10 or 100
3. I can make links between numbers
4. I can explain the logic behind these mental calculations.

**Guided Practice**

Add mentally.

1. (3041) + 9 = [ ] + 10 = [ ]

2. (599) + 4712 = 600 + [ ] = [ ]

3. (2998) + 499 = [ ] + [ ] = [ ]

4. (4375) + 25 = [ ] + [ ] = [ ]

00:10 00

Discuss each step with your group – remember … prove it! How do you know?

My reasons for how I know are...

To be able to add using mental strategies.

1. I can use my number bonds to 10 and 100.
2. I can recognise when I need to make 10 or 100
3. I can make links between numbers
4. I can explain the logic behind these mental calculations.

# Guided Practice answers

## Guided Practice

Add mentally.

1. $3041 + 9 = \boxed{3040} + 10 = \boxed{3050}$

2. $599 + 4712 = 600 + \boxed{4711} = \boxed{5311}$

3. $2998 + 499 = \boxed{3000} + \boxed{497} = \boxed{3497}$

4. $4375 + 25 = \boxed{4300} + \boxed{100} = \boxed{4400}$

# Maths journals are ...

**Descriptive** – Pupils describe what methods they have used.
'Can you write a set of instructions for a friend so that they can solve this problem?'

**Evaluative** – Pupils have to make and justify choices.
'Why did you choose those methods? How were they helpful?'

**Creative** – Pupils are encouraged to develop their own methods/stories.
'Can you write a story to go with this problem? Can you invent a new method?'

**Investigative** – Pupils record their findings after exploring a problem.
'Did you see any patterns? What helped you in this investigation?'

**Formative** – Pupils demonstrate their understanding and progress.
'Can you choose a question you couldn't do/found challenging and explain what was tricky? Choose one problem you are proud you were able to answer.'

# Number Patterns

When you add 1000, 100, 10 or 1 to a number one of the didgits goes up one number 5 if you add 1000 to 6828 you would only change the 6 which would turn into a 7 and the answer would become 7828.

Here is a number pattern:

1285, 2285, 3285, 4285, 5285, 6285, 7285, 8285, 9285

One of my mistakes was that I added one thousand istead of ten. Next time I will use counting to counters. next time to help me.

*Super! We love mistakes!* ☺

| Th | H | T | O |
|----|---|---|---|
| 5  | 3 | 2 | 8 | − 1000
| 4  | 3 | 2 | 8 |

```
  5 3 2 8
− 1 0 0 0
─────────
  4 3 2 8
```

I have helped Tatianq by using counters. I explained to her that when you use sounters if you start with the start number you just add one counter. It's makes it easy.

☆ Thank you! Helping somebody is a great way of proving your understanding.

| To be able to add using mental strategies. | 1. I can use my number bonds to 10 and 100. <br> 2. I can recognise when I need to make 10 or 100 <br> 3. I can make links between numbers <br> 4. I can explain the logic behind these mental calculations. |
|---|---|

## Workbooks (pg 33)
Complete this independently.

**0:0:16 0:0**
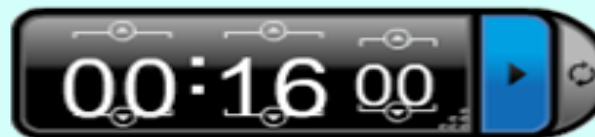
### Finished?

Try this challenge question.

Journal your understanding – prove your learning!

Can you come up with any of your own problems?

**True or False**

Explain why as fully as you can in full sentences.

1. 100 more than 505 is less than 400.

2. 10 less than 356 is the same as 100 more than 246.

3. £100 more than £983 is equal to £1 less than £1084.

4. If Sam has 927 sweets and he gives Tim 100, Max 10 and Ali 1, he will have 806 sweets left.

TIP: do the working out in 3 steps

Extension – finding 10, 100 or 1000 more or less than a given number.

Extend Page

| To be able to add using mental strategies. | 1. I can use my number bonds to 10 and 100. 2. I can recognise when I need to make 10 or 100 3. I can make links between numbers 4. I can explain the logic behind these mental calculations. |
| --- | --- |

**Working wall:**

Have you anything that has inspired your learning today? Would you like to add it to our working wall?

# Impacts

▶ Developing into problem solvers not human calculators! KS2 testing is changing and moving towards demonstrating understanding through reasoning.

▶ Greater conceptual understanding of number and calculation.

▶ Visualise and reason more readily due to a more in-depth understanding.

▶ Struggling learners fully supported:
  ▶ accessing concrete equipment
  ▶ use of visual models to support understanding.

▶ Confident learners will be challenged:
  ▶ exposure to unfamiliar problems in unfamiliar contexts
  ▶ development of reasoning skills
  ▶ exploring multiple ways to manipulate numbers and solve problems.

▶ Small group support later the same day and at other timetabled occasions.

▶ After each topic, children complete a review to show progress.

# How to help at home

► Times tables

► School website with videos to detail the approaches taken.

► Promote mathematical discussion in real life context. EG: shopping, cooking etc.

► Encourage reasoning: "Show me what you mean." "How can you prove it?" "Explain how you know."



Maths

Fundmental Idea

The fundamental idea in maths is explained: the principle that we can only add two or more items (or "nouns") when they are both the same.

Number Bonds

$1 + 5 = 6$

In this section

SEND (Special Educational Needs and Disability)

Curriculum Overviews

Maths

Arts

Music

Sport

Internet Safety

Educational Visits

Pupil Responsibilities

Coaching