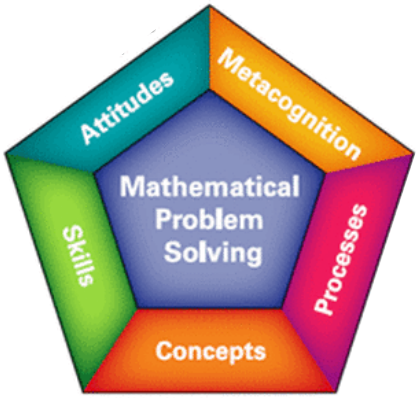
Lomond School

Singapore Maths

in the Junior School



What is Singapore Maths?

Although Singapore is now a world leader in Maths attainment, this was not always the case. In the 1980s, Singapore decided to act on current research and recommendations, including the 1982 Cockcroft Report carried out in the UK which stated that:

- problem solving is at the heart of mathematics and should be the focus of what is taught in schools
- basic skills in mathematics should include more than computing answers using a learnt method

Singapore use a 'mastery' approach. This recognises that a child's confidence to learn will have an impact on their attainment. Children should be taught using strategies which allow understanding to become fully embedded and therefore 'mastered'. Once mastered, it is easier to build upon current knowledge and only once a child understands something will they be able to use it in a meaningful way.

Why are we using it at Lomond?

Maths attainment is already very high at Lomond Junior School. However, anxiety surrounding Maths is a nationwide problem and at times, can be a barrier to learning. Even the most able children can see Maths as a subject that only has a right or a wrong answer, rather than as a continuum of understanding.

The willingness to be open-minded towards our learning and not be afraid of failure are key to success in any learning context. Our aim is to try to change attitudes towards Maths, ensuring that pupils see mathematical thinking as a useful skill for life.

'Knowing what to do and why' (Richard Skemp, 1976)

Maths is about so much more than answering 'sums'. Our small classes allow meaningful discussions to take place which enhance learning and teachers can meet the needs of each individual in a responsive way.

The carefully planned, visual nature of the Singapore approach provides lots of support for children who may need reinforcement, whilst the focus on problem-solving allows our most able children to be challenged by accessing rich and sophisticated problems at each stage. This results in an environment where children of all abilities can work and learn together, each one being challenged and supported appropriately.

Key Features of the Singapore Approach

The Singapore approach uses a range of consistent and purposeful techniques, which work together to deepen understanding of mathematical concepts.

1. Concrete - Pictorial - Abstract (CPA)
2. Part - Whole Model
3. Bar Modelling
4. Discussion

Concrete - Pictorial - Abstract (CPA)

CPA is a highly effective approach to teaching that develops a deep and sustainable understanding of Maths. This gradual and systematic approach, developed by American psychologist Jerome Bruner, is the mainstay of Maths teaching in Singapore.

Concrete

Concrete is the 'doing' stage; using concrete objects to model problems. Instead of the traditional method of teaching Maths, where a teacher demonstrates how to solve a problem, the CPA approach brings concepts to life by allowing children to experience and handle physical objects. Every new abstract concept is learned first with a physical experience.

For example, if a problem is about adding four baskets of fruit, the children might handle actual fruit before progressing to handling counters or cubes which are used to represent the fruit. Although this may seem a trivial detail, the physical experience helps develop the cognitive processes which lead to understanding. It also ensures that children understand the purpose of the skill they are learning, and how they are able to apply it in the real world.

The use of concrete resources, or manipulatives (cubes, counters, Numicon etc.), is often misunderstood in the United Kingdom as they are seen as a tool for very young children, or to support weaker learners. Although they are often used in this way, they can be far more powerful and used well, can enhance the learning of even the most advanced learners. Their purpose is to allow children to visualise and make connections between different mathematical concepts.

This in turn helps children understand the mechanisms and patterns behind any algorithm and allows them to apply their knowledge to far more challenging problems. All of this ensures that children have a secure foundation on which they can continue to build, reducing the amount of time required to revise core concepts.

It is important to recognise that the CPA model is a progression. Ultimately, children will work completely in abstract terms, but will understand the processes and be able to apply their knowledge effectively

Pictorial

Pictorial is the 'seeing' stage, using representations of the objects to model problems. This stage encourages children to make a mental connection between the physical object and abstract levels of understanding by drawing or looking at pictures, circles, diagrams or models which represent the objects in the problem.

Building or drawing a model makes it easier for children to grasp concepts they traditionally find more difficult, such as fractions, as it helps them visualise the problem and make it more accessible.

Abstract

Abstract is the 'symbolic' stage, where children are able to use abstract symbols to model problems. We are so familiar with numbers it is easy to forget that they are abstract symbols. It is crucial that children fully understand what a number actually represents if they are to go on and be successful with fractions and algebra!

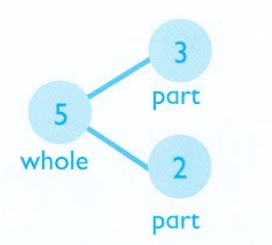
For example, what do you know about 7?

It is an odd number
It is three fewer than 10
It is made up of a 3 and a 4
It is a single digit number
It is half of 14
It is double three and a half
It is a prime number
It comes after 6 and before 8
It is fewer than 10
It is a quarter of 28 and so on……..

2. Part - Whole Model

This model works on the principle that if you know two values, you can always calculate the third.

This can be used in Junior 1 for the most simple examples, such as:

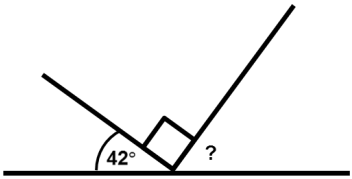


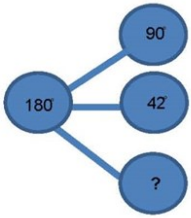
2 + 3 = 5 **5 - 3 = 2**

3 + 2 = 5 **5 - 2 = 3**

This visually reinforces the connection between addition and subtraction from the very beginning.

It can also be used in Transitus 1 and 2 for examples such as:

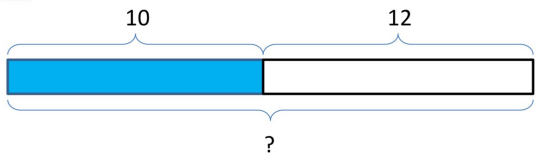




3. Bar Modelling

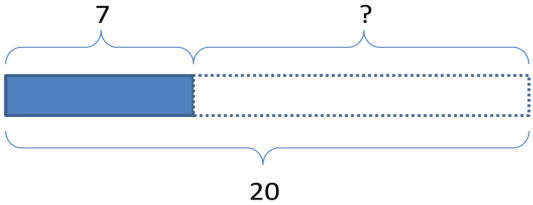
The bar model method is a strategy used to visualise mathematical concepts and problems. It involves drawing a simple diagram to help represent a situation. Simple bar models, like the examples shown below, also reinforce the concept of the Part - Whole Model, ensuring a consistent, logical approach. Here, we can see that if two values are known, the third can be calculated.

If Sam has 10 toy cars and Sarah has 12, how many do they have altogether?



10 + 12 = ☐

James collected 20 eggs from his chickens. He dropped 7 of them on his way inside. How many eggs were left?



7 + ☐ = 20

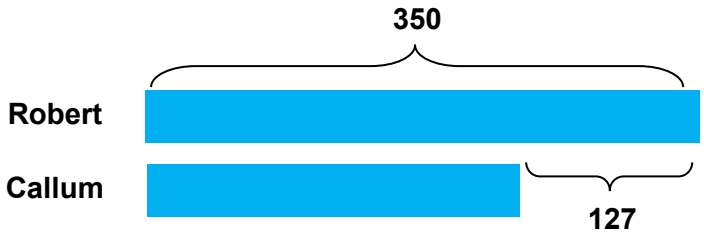
20 - 7 = ☐

These models help to represent visually what is going on in the ‘missing number’ calculations which are more familiar.

3. Bar Modelling (cont'd)

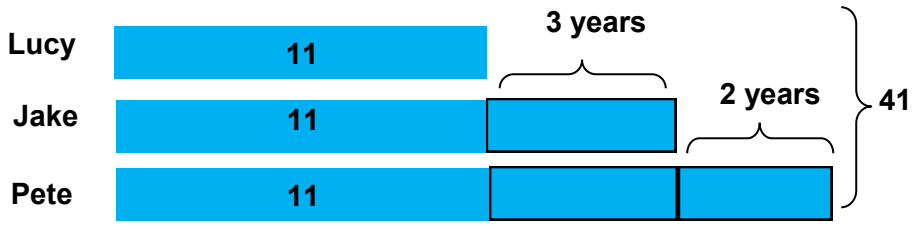
A comparison bar model

Robert scored 350 points on Sports Day. Callum scored 127 points less than Robert. How many points did Callum score?



Although the examples used for illustration have been simple, the bar model is a powerful tool which can be used to aid problem solving at all levels.

Jake is 3 years older than Lucy and 2 years younger than Pete.
The total of their ages is 41 years old. Find their ages.



Lucy = 11

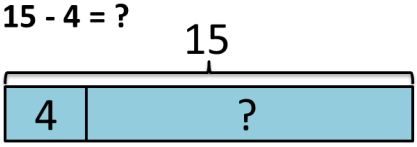
Jake = 14

Pete = 16

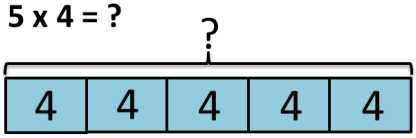
3. Bar Modelling (cont..)

The particular power of the bar modelling pictorial approach is that it is applicable across a large number of topics. The careful and considered structure of the Singapore method means that the imagery and techniques introduced from the start apply throughout the course, ensuring children recognise, remember and understand, allowing children to build on their prior learning more effectively.

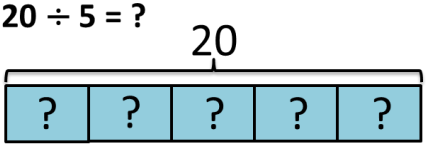
15 - 4 = ?



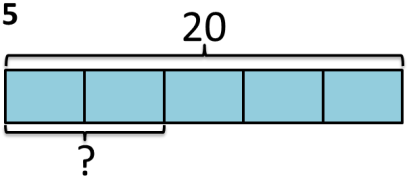
5 x 4 = ?



20 ÷ 5 = ?



$\frac{2}{5}$ of 20 = ?



Many children who are competent mathematicians find applying knowledge in unfamiliar contexts, or solving complex word problems very challenging. This is often because they are not used to being “stuck” and lack the strategies to tackle something that isn’t immediately obvious.

It can be difficult to decide which mathematical operations to use when trying to understand a problem. Bar models do not solve the problem, but they help children visualise the situation which in turn makes it easier to identify what they actually have to do to solve the problem. These models can also help children to record and communicate their understanding of a particular problem and identify any misconceptions or areas of difficulty.

4. Discussion

Talking about Maths is actively encouraged during lessons. Most lessons will start with a problem or a story related to the lesson ahead. This not only gives the lesson a context and a purpose, but promotes discussion and debate. Children are encouraged to think creatively and share their ideas. Open questions are often used to highlight to children that there can be different methods used to get to a solution and that there is not always only one answer.

Children are encouraged to communicate their thinking, using concrete materials, diagrams and words. This allows teachers to identify any misconceptions and assess depth of understanding to inform their next steps.

This approach develops confidence and critical thinking in our pupils and puts problem-solving at the heart of mathematics.

Key Questions

- What is the part? What is the whole?
- What's the same and what's different?
- Can you prove it?
- Can you show the same thing another way?
- How do you know?

Curriculum

Our Maths Curriculum is split into 2 distinct parts:

- Conceptual understanding and problem solving
- Number Sense

Conceptual understanding and problem solving makes up the main part of our teaching, ensuring our pupils have a good foundation of the 4 operations (addition, subtraction, multiplication and division) when using whole numbers and fractions. Our curriculum also includes topics on geometry and handling data.

Number Sense is a combination of learned facts ('Know It') and mental arithmetic strategies ('Think it') which are practised at home and at school daily. Having good number sense helps children to compute answers more quickly and accurately. It also allows them to focus on the more challenging problem solving aspect of mathematics and so is a very valuable skill.

It is important for children to know that being *good* or *bad* at times tables does not make them *good* or *bad* at Maths. Children with good memories, or those who exert time and effort will be more successful at learning number facts. Having a bank of knowledge only helps children and should be encouraged, however children who find this difficult are still capable of thinking mathematically and being successful. Good number sense is desirable and worth working hard to achieve, but should not be seen as a limiting factor for children. Written methods, notes and for older children, a calculator can support mathematical thinking and allow success in problem solving and application.

Ultimately, we want all of our children, and their parents, to realise that they can enjoy Mathematics and be successful.

Supporting Your Child at Home

Without doubt, the most important thing a parent can do to support their child with Maths is be positive! If you have a negative view of Maths, try not to pass this on to your child

If a child is having difficulty with a particular concept, try not to panic or worry. This is common when new things are introduced and some time and patience is often required. Reassure your child that they don't understand……..yet! But with some perseverance and positive attitude it usually does. If you are worried, speak to the class teacher.

It is often best to leave the teaching of particular concepts and methods to the class teachers as a different approach can leave children more confused and frustrated. If you would like to give your child this type of support, please speak to the class teacher first who can ensure you have the right information.

However, the best support is the simplest and this can be done as part of daily life, rather than extra school work.

Easy things to practise at home

- Number facts (counting, times tables, number bonds etc.)
- Telling the time
- Using money
- Mental arithmetic (at the shops etc.)
- Measuring (cooking, baking, DIY)
- Money management (earning/spending/saving pocket money)

Mrs Ailsa Lawn

Head of Junior School

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