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The Model Method

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Background

- In the late 1970s in Singapore low achievement in mathematics was a concern.

- The Curriculum Development Institute of Singapore (CDIS) was established in June 1980.

- The primary mathematics curriculum (detailed syllabuses, textbooks, workbooks and teacher guides) were developed by the CDIS.

- The curriculum adopted the Concrete-Pictorial-Abstract approach for the teaching and learning of mathematics.

- In 1983, the team writing the primary mathematics curriculum materials, led by Dr Kho, at CDIS made a breakthrough to address difficulties students were having with word problems.

- They introduced the 'Model Method' in the curriculum for primary 5 and 6 students in the late 1980s.

- This method proven to be useful is now introduced to students in primary 1.

- The method uses a structured process whereby students are taught to visualise abstract mathematical relationships and their varying problem structures through pictorial representations.
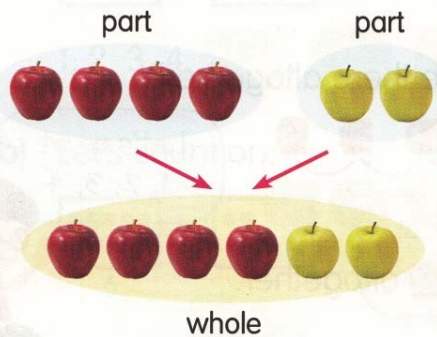
What is the model method?

- A tool for representing and visualising relationships

- A key heuristic students' use for solving whole number arithmetic (WNA) word problems in Singapore elementary schools
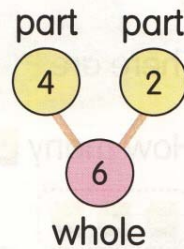
Part-Whole Model

Adding the parts to find the total
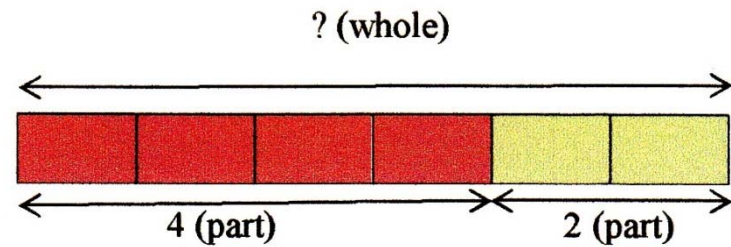
1 How many apples are there **altogether**?
Let's add.

part part

Let's count on from 4.
5, 6.
You can also add with
number bonds.

part part
4 2

6

whole

There are 6 apples altogether.
4 and 2 make 6.

whole

? (whole)

4 (part)   2 (part)

The CPA and part- whole model

Comparison Model

Comparing Numbers

See and Learn

① Janice — Siti
Janice has as many paper clips as Siti. (12)

② Siti (12) — Ravi (17) — Peter (10)
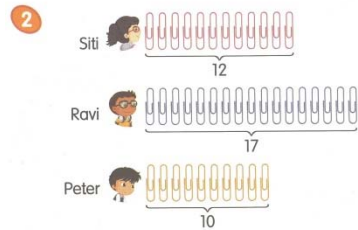
Ravi has more paper clips than Siti and Peter.
Peter has fewer paper clips than Siti and Ravi.

17 is greater than 12 and 10.
10 is smaller than 12 and 17.
17 is the greatest number.
10 is the smallest number.

Siti — 12
Ravi — 17 — 5
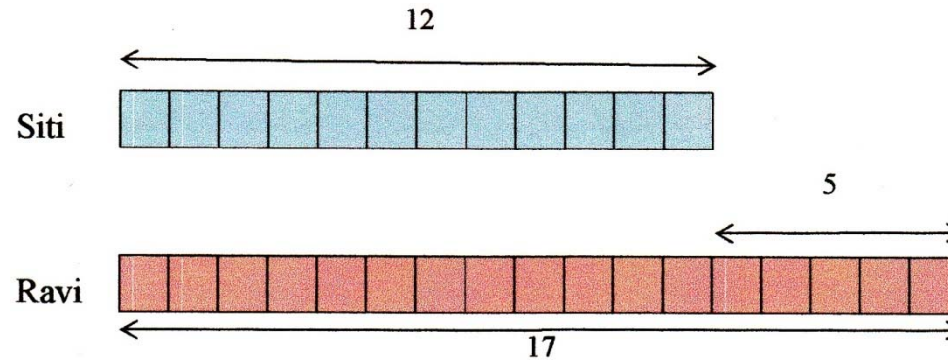
The CPA and comparison approaches

Word problems involving + , − , × , ÷

2-Part Word Problems

See and Learn

1 Ramli has 265 strawberries and 184 mangoes.
(a) How many fruits does he have altogether?
(b) How many fewer mangoes than strawberries does he have?

(a)

265	184
strawberries	mangoes

?

265 + 184 = 449

H	T	O
^{1}2	6	5
+ 1	8	4
4	4	9

He has 449 fruits altogether.

(b)

265
strawberries

mangoes

184   ?

H	T	O
^{1}2	^{16}6	5
− 1	8	4
	8	1

265 − 184 = 81

He has 81 fewer mangoes than strawberries.

2 At a mall, Mrs Tan spent 4 times as much money as Mrs Lim.
(a) How much did Mrs Lim spend if Mrs Tan spent $988?
(b) How much did they spend altogether?

(a)

$988

Mrs Tan

Mrs Lim   ?

?

$$\begin{array}{r} 2\ 4\ 7 \\ 4\overline{)9\ 8\ 8} \\ -8 \\ \hline 1\ 8 \\ -1\ 6 \\ \hline 2\ 8 \\ -2\ 8 \\ \hline 0 \end{array}$$

$988 ÷ 4 = $247

Mrs Lim spent $247.

(b) 5 × $247 = $1235   or $988 + $247 = $1235
They spent $1235 altogether.

$$\begin{array}{r} ^2 2\ ^3 4\ 7 \\ \times 5 \\ \hline 1\ 2\ 3\ 5 \end{array}$$

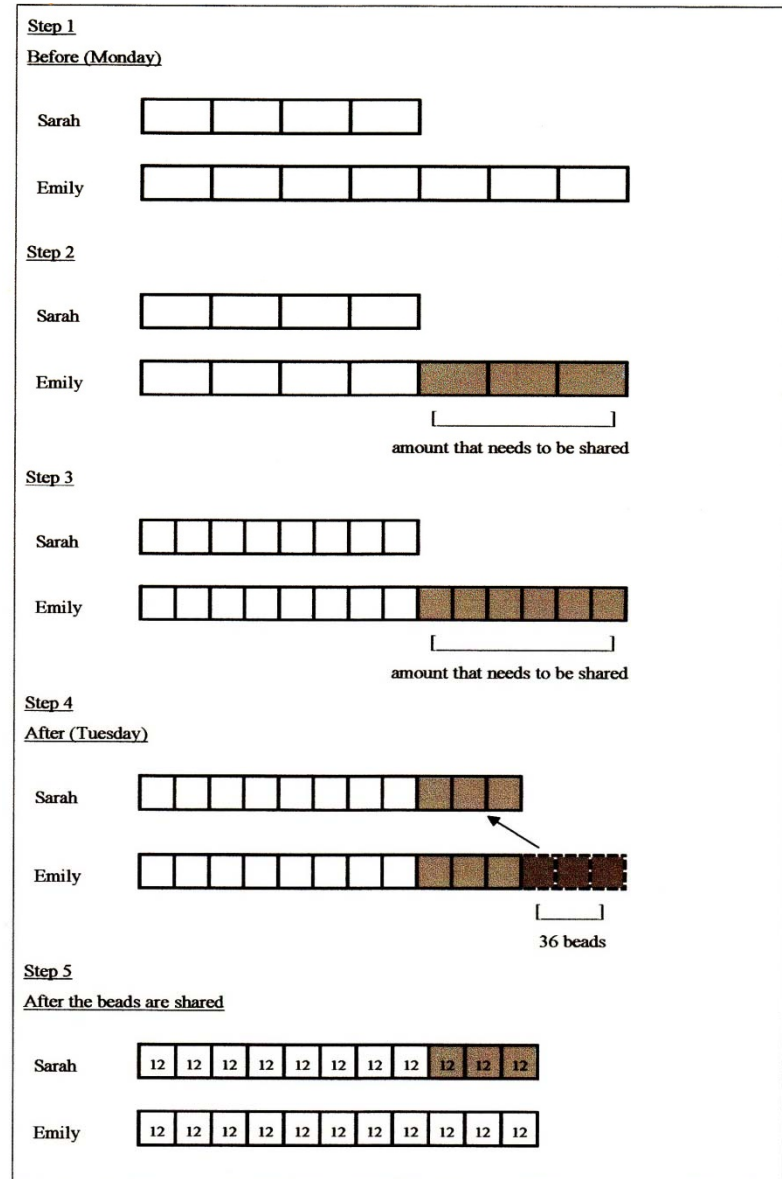# Problem Solving – Using Models and the Before – After Concept

In Mariam's aquarium, there are swordtails and guppies. 25% of the fish are swordtails. Mariam then buys more swordtails and puts them into the aquarium to double their number. What percentage of the fish are guppies after she doubles the number of swordtails?

Solution

Before			
Swordtails 25 %	Guppies 25 %	Guppies 25 %	Guppies 25 %

After				
Swordtails 20 %	Swordtails 20%	Guppies 20 %	Guppies 20 %	Guppies 20 %

Answer: 60 %

On Monday, the ratio of the number of beads Sarah had to the number of beads Emily had was 4:7. On Tuesday, after Emily gave 36 beads to Sarah, they both had the same number of beads. How many beads did Sarah have on Monday?

Step 1
Before (Monday)

Sarah

Emily

Step 2

Sarah

Emily

amount that needs to be shared

Step 3

Sarah

Emily

amount that needs to be shared

Step 4
After (Tuesday)

Sarah

Emily

36 beads

Step 5
After the beads are shared

Sarah | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

Emily | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

What Research Says about the Model Method

- A rigorous study by Ng and Lee (2009) of the model method clarified that the method engages students in capturing the inputs, the relationships between the inputs, and the output of the problem.

- They noted that after students construct a model, they use it "to plan and develop a sequence of logical statements, which allows for the solution of the problem".

- Their study also noted that "average ability children's solution of word problems involving whole numbers could be improved if they learn to exercise more care in the construction of related models".

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Thank you

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