

The Model Method: A Tool for Representing & Solving Word Problems





Workshop Objective

You will be guided through some of these problem solving methods and strategies which include

- different stages of problem solving
- model-drawing

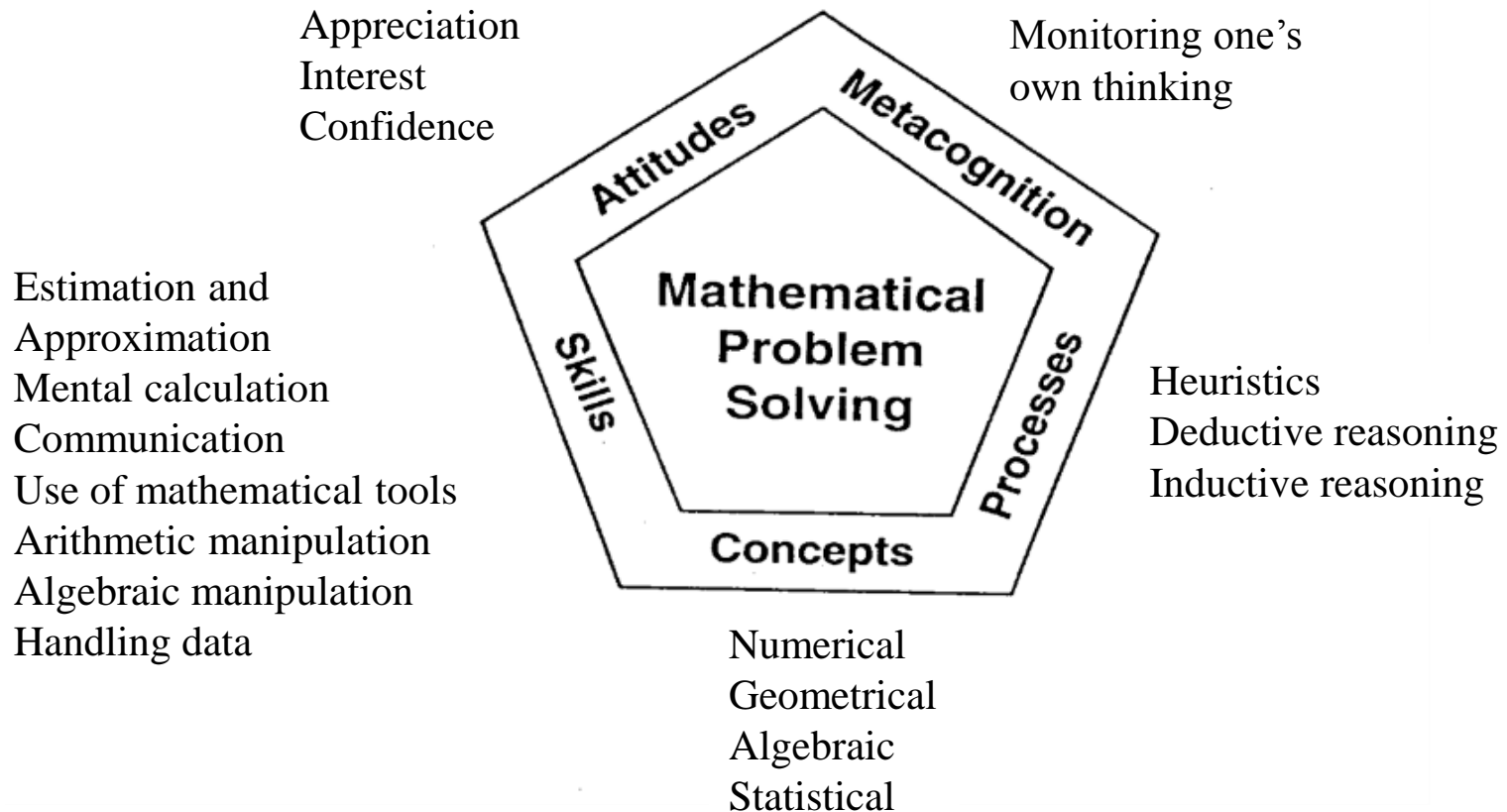


Workshop Overview

- Mathematics Curriculum Framework
- Stages of Problem Solving
- Introduction to the Model Method
- Hands-on Experience

MOE Mathematics Curriculum Framework

1991 - 2000



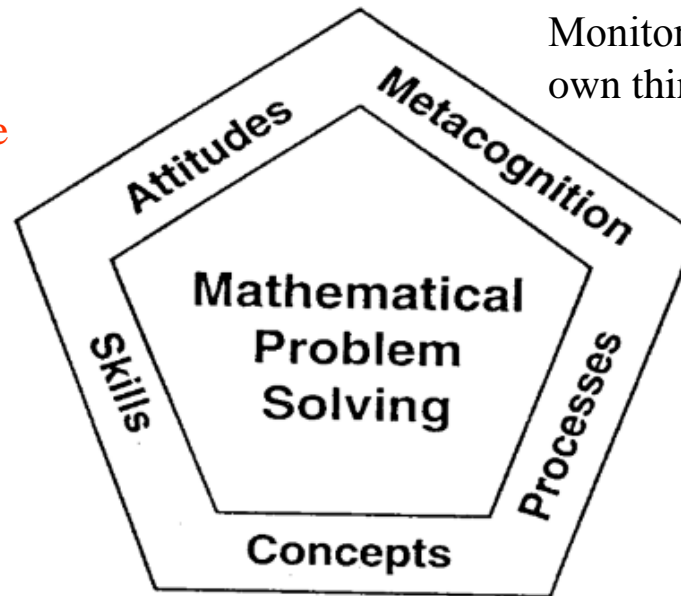
MOE Mathematics Curriculum Framework

2001 - 2006

Appreciation
Interest
Confidence
Perseverance

Monitoring one's
own thinking

Estimation and
Approximation
Mental calculation
Communication
Use of mathematical tools
Arithmetic manipulation
Algebraic manipulation
Handling data



Heuristics
Thinking skills

Numerical
Geometrical
Algebraic
Statistical

MOE Mathematics Curriculum Framework

2007 & Beyond

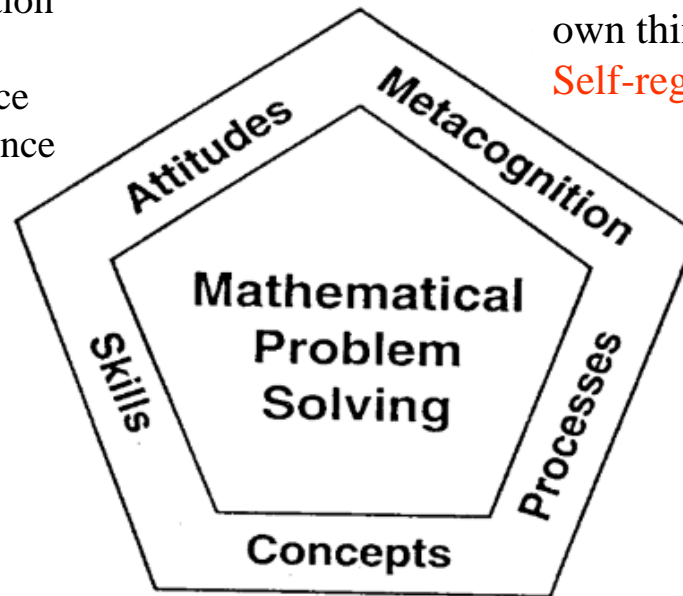
Beliefs

Appreciation
Interest
Confidence
Perseverance

Monitoring one's
own thinking

Self-regulation of learning

Numerical calculation
Algebraic manipulation
Spatial visualisation
Data analysis
Measurement
Use of mathematical tools
Estimation



Reasoning,
communication &
connections
Applications and
modeling
Thinking skills and
heuristics

Numerical
Geometrical
Algebraic
Statistical
Probabilistic
Analytical



Phases in Problem Solving

- Understanding the Problem
- Devising a plan to solve the problem
- Carrying Out the Plan
- Looking Back

Learning from research about the model method...

The table show the strategies used by pupils and their success rate.

Pupils	Used the model method		Used number sentences	
	No. of pupils	No. successful	No. of pupils	No. successful
High-achievers n = 3	3	3	0	0
Mid-achievers n = 10	10	10	0	0
Low-achievers n = 19	10	8	3	1

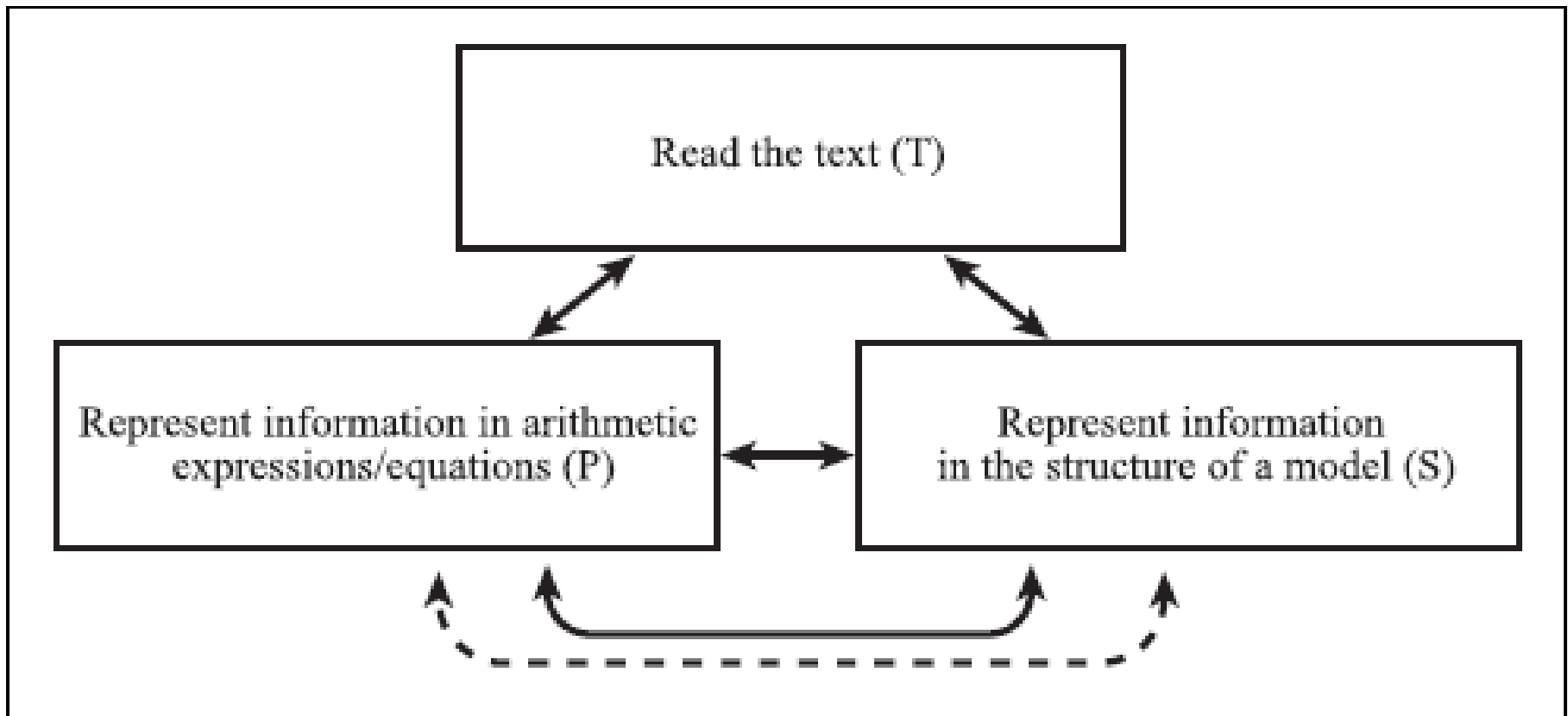


Learning from research about the model method...

Six potential areas of difficulty pupils have when solving word problems:

1. Difficulty in reading the text
2. Difficulty in comprehending the text
3. Lack suitable strategies to handle the problem
4. Not able to transform information in the text into mathematical forms
5. Lack computational skills
6. Unable to use computation results to solve the problems

Phases of Problem Solution by Children Using the Model Method





The Model Method helps pupils to ...

- visualise the situations described in word problems
- gain a deeper understanding of the operations they may use to solve problems
- see relationships between and among the variables in the problem



Features of Bar Models...

- The length of the rectangular bars should be drawn in proportion to each other
 - Captures constraints given in the problem
 - Shows the relationship between and among quantities
- The available information is recorded onto the models and question marks are used to indicate the computation needed to find unknown information

Concepts:

1. **Repeated Identity**
2. **Remainder Concept**
3. **Part Unchanged Concept**
4. **Internal Transfer, Total Unchanged Concept**



Repeated Identity (Ratio)

Jenny, Mabel and Kelly had some toys. The ratio of the total number of toys Mabel and Kelly had to what Jenny had was $3 : 1$. The ratio of the total number of toys Mabel and Jenny had to what Kelly had was $1 : 2$. If Jenny had 140 toys less than Kelly, how many toys did Jenny have?

Repeated Identity (Fractions)

Jenny, Mabel and Kelly had some toys. The number of toys Jenny had was $\frac{1}{3}$ the total number of toys Mabel and Kelly had. The total number of toys Mabel and Jenny had was $\frac{1}{2}$ of what Kelly had. If Jenny had 140 toys less than Kelly, how many toys did Jenny have?

Repeated Identity (Whole Numbers)

$$M \text{ and } K : J = \frac{J}{M \text{ and } K} = \frac{1}{3}$$

Jenny, Mabel and Kelly had some toys. The number of toys Mabel and Kelly had was **three times** as many as what Jenny had. The total number of toys Mabel and Jenny had was **half** of what Kelly had. If Jenny had 140 toys less than Kelly, how many toys did Jenny have?

$$M \text{ and } J : K = \frac{M \text{ and } J}{K} = \frac{1}{2}$$

Remainder Concept (Fractions & Ratio)

At first, Nikesh had some money. He spent $\frac{1}{4}$ of it on a bag and $\frac{2}{5}$ of the remainder on a shirt. After that, his parents gave him \$160. The ratio of the total amount of money he had at the end to the amount of money he had at first was 5 : 4. How much money did Nikesh have at first?

Remainder Concept (Percentage & Ratio)

At first, Nikesh had some money. He spent of $\frac{2}{5}$ of it on a bag and $\frac{1}{4}$ of the remainder on a shirt. After that, his parents gave him \$160. The ratio of the total amount of money he had at the end to the amount of money he had at first was 5 : 4. How much money did Nikesh have at first?



Part Unchanged Concept

In November, Jenny spent 80% of her monthly salary. In December, her monthly salary increased by \$200 and she saved 15% of her new salary. Given that she saved the same amount of money in the two months, find her monthly salary in December.

Part Unchanged Concept

80%

In November, Jenny spent $\frac{4}{5}$ of her monthly salary. In December, her monthly salary increased by \$200 and her saving was $\frac{3}{20}$ of her new salary.

15%

Given that she saved the same amount of money in the two months, find her monthly salary in December.

Part Unchanged Concept

$$\frac{4}{5} = 80\%$$

In November, the ratio of Jenny's spending to her monthly salary was $4 : 5$. In December, her monthly salary increased by \$200 and the ratio of her monthly savings to her monthly salary was now $3 : 20$. Given that she saved the same amount of money in the two months, find her monthly salary in December.

$$\frac{3}{20} = 15\%$$

Internal transfer, Total Unchanged Concept

The ratio of Benny's money to Charlie's money was 11: 4. When Benny gave \$360 to Charlie, Charlie had twice the amount of money Benny had. How much money did Benny have at first?

Internal transfer, Total Unchanged Concept

Charlie had $\frac{4}{11}$ as much money as Benny. After Benny gave \$360 to Charlie, he had 50% as much money as Charlie. How much money did Benny have at first?

A blue box containing the ratio $4 : 11$. A blue arrow points from the fraction $\frac{4}{11}$ in the text above to this box.

$$4 : 11$$

A blue box containing the fraction $\frac{1}{2}$. A blue arrow points from the text "he had 50% as much money as Charlie" to this box.

$$\frac{1}{2}$$

■ More Problem-solving Heuristics Websites :

<http://www.onlinemathlearning.com/singapore-math.html>

■ Video & worksheets on model-drawing

<http://www.thesingaporemaths.com/stratf.html>

■ Ask and Learn Portal



Q & A



