Singapore Math: Theory and Practice

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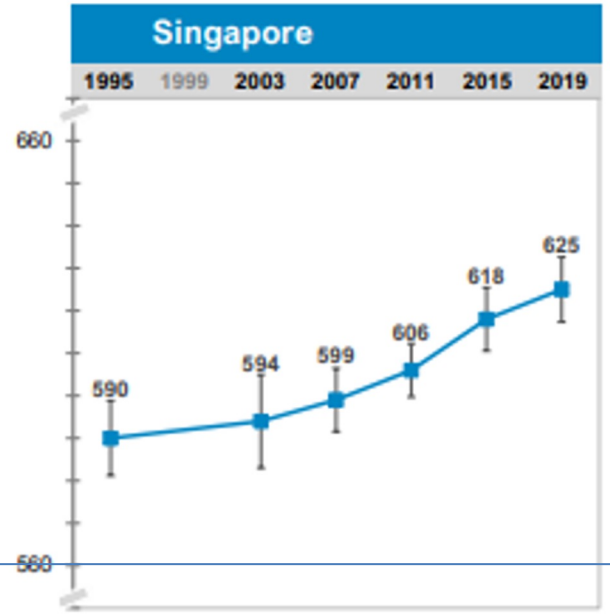

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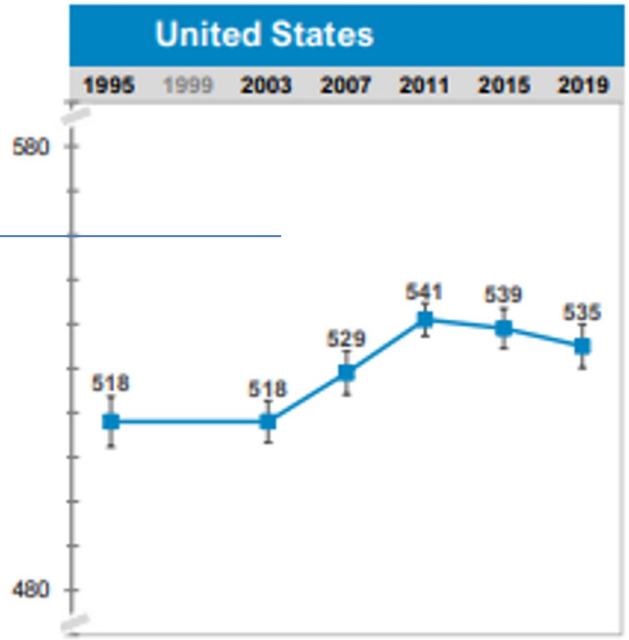
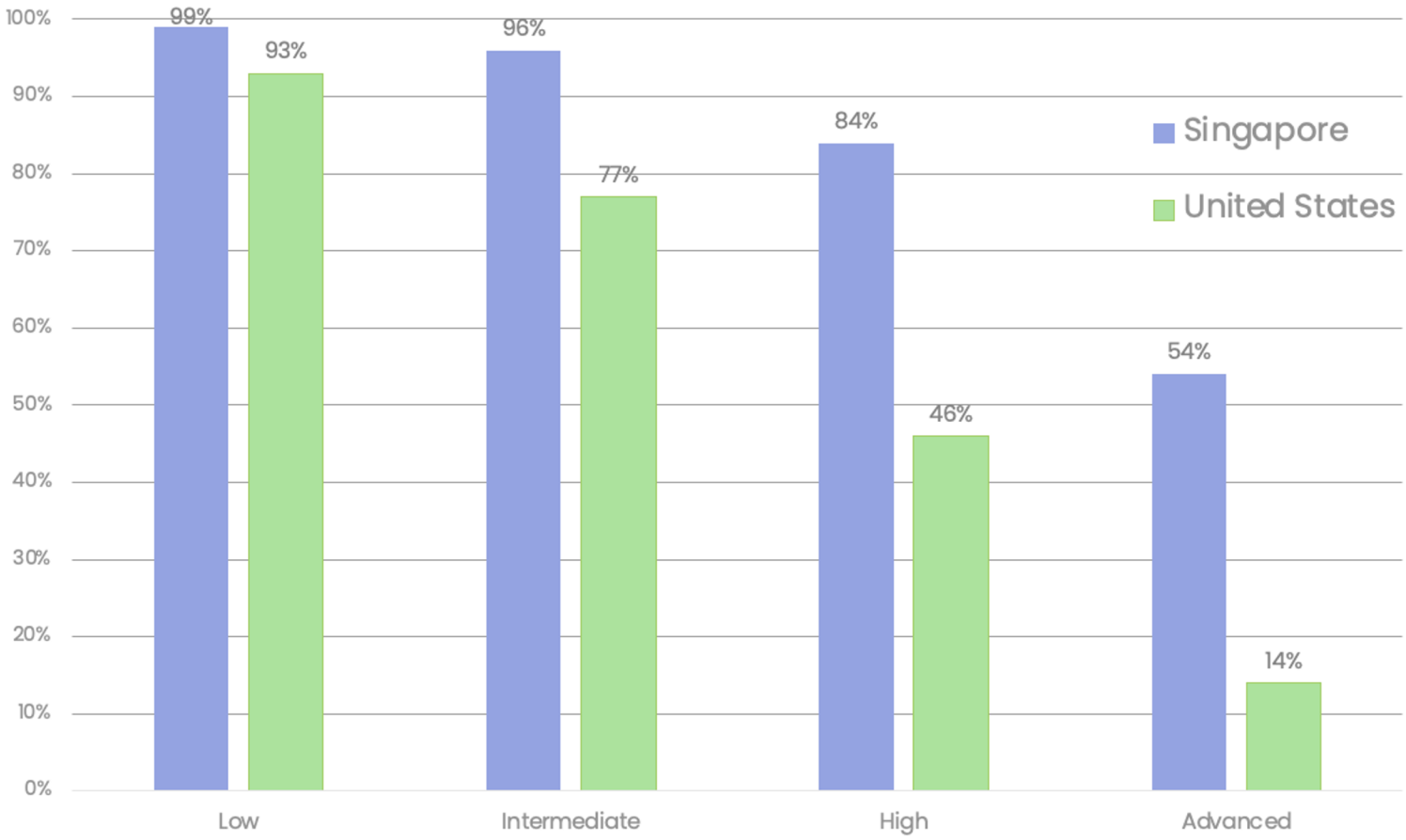
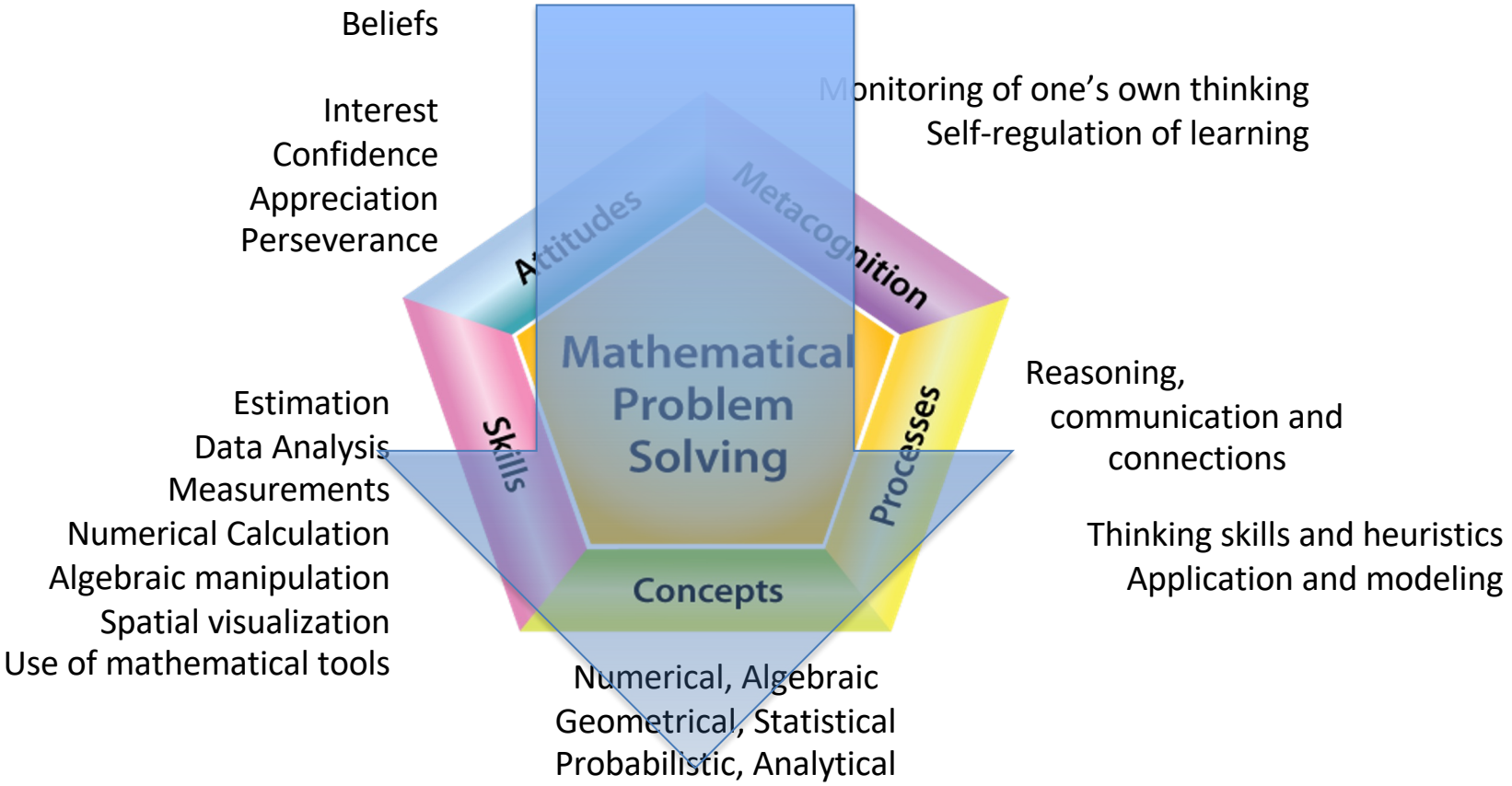
IEA TIMSS & PIRLS International Study Center Lynch School of Education BOSTON COLLEGE



Percentage of grade 4 students meeting TIMSS benchmarks 2019

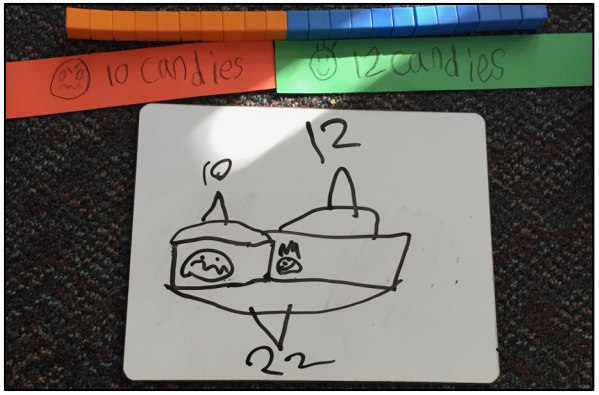


The Singapore Mathematics Framework



Fundamentals of Singapore Math

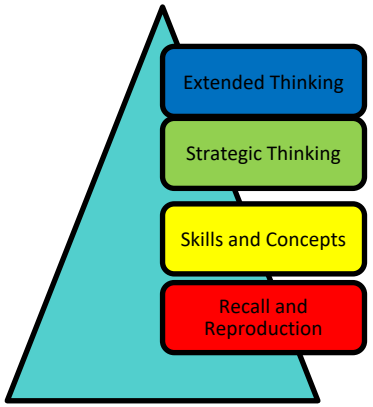
Concrete-Pictorial-Abstract



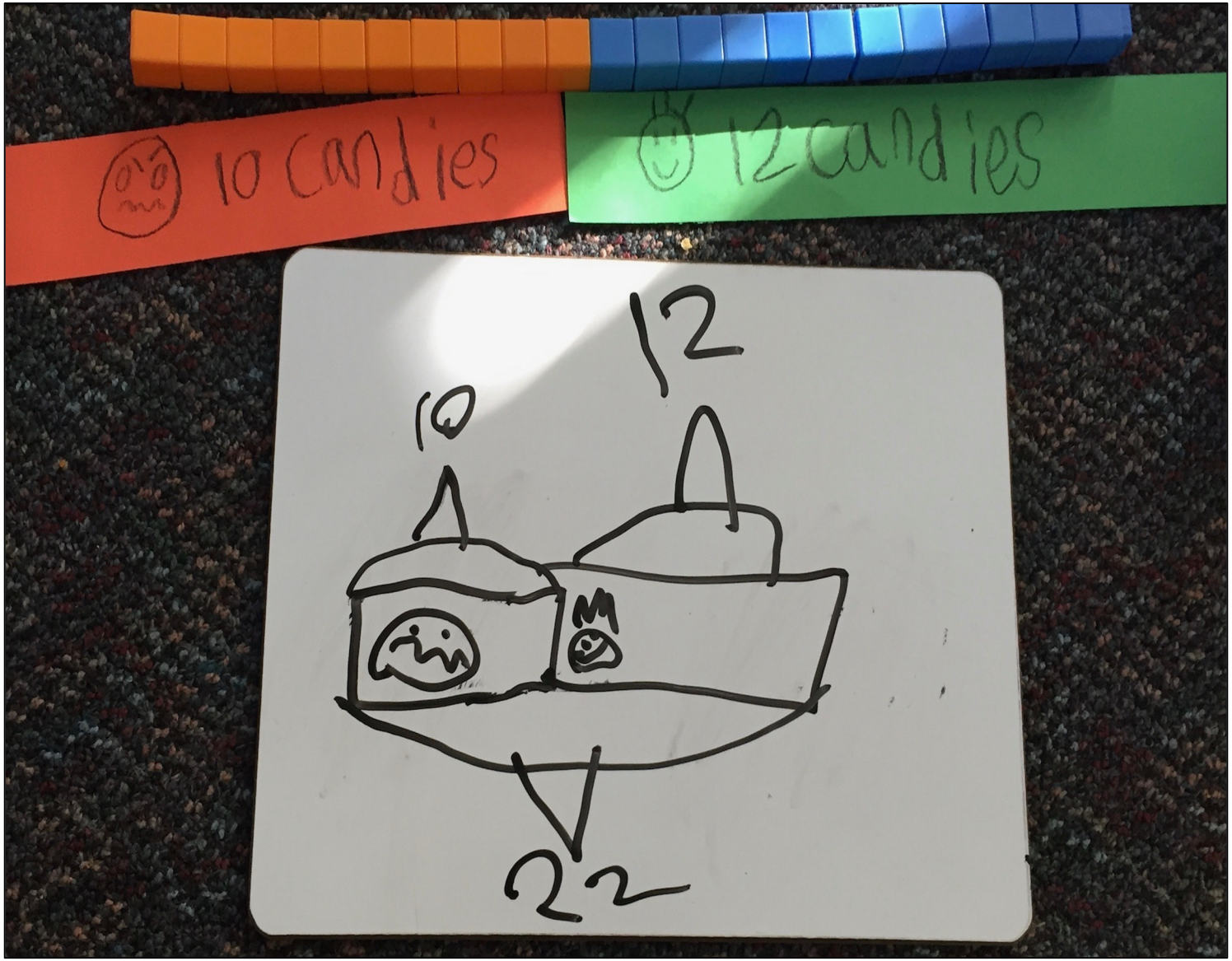
Visualization

Variation

Constructing Meaning



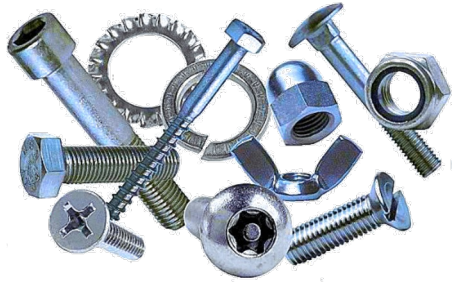
Concrete-Pictorial-Abstract



Math Manipulatives at Home

In the Kitchen: Spoons, forks, toothpicks, pasta, beans, egg cartons, muffin tins

In the Playroom: Lego, checkers or backgammon pieces, craft sticks, Jenga



In the Garage: Screws, washers, nuts

Visualization

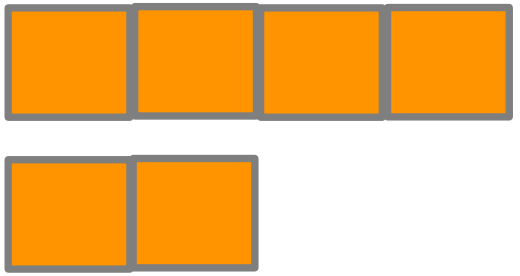
Visualization through Bar Modeling

Parts

Compariso n

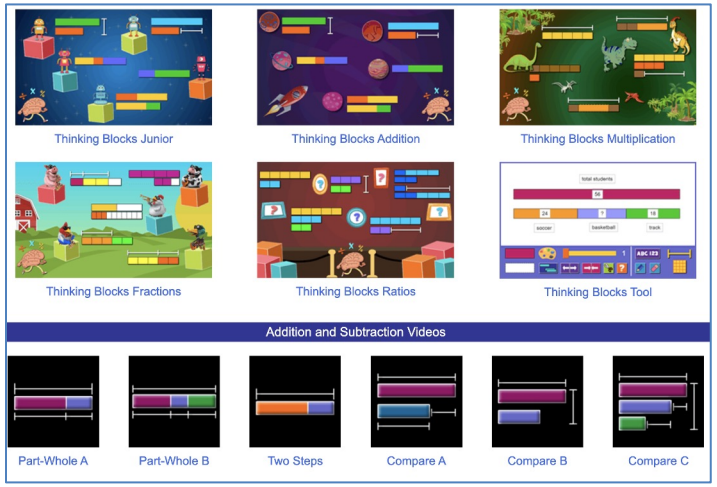
+ or -

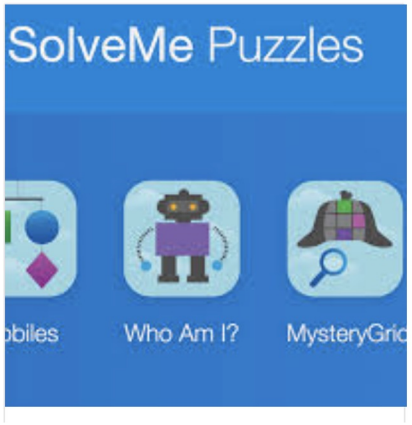
x or ÷

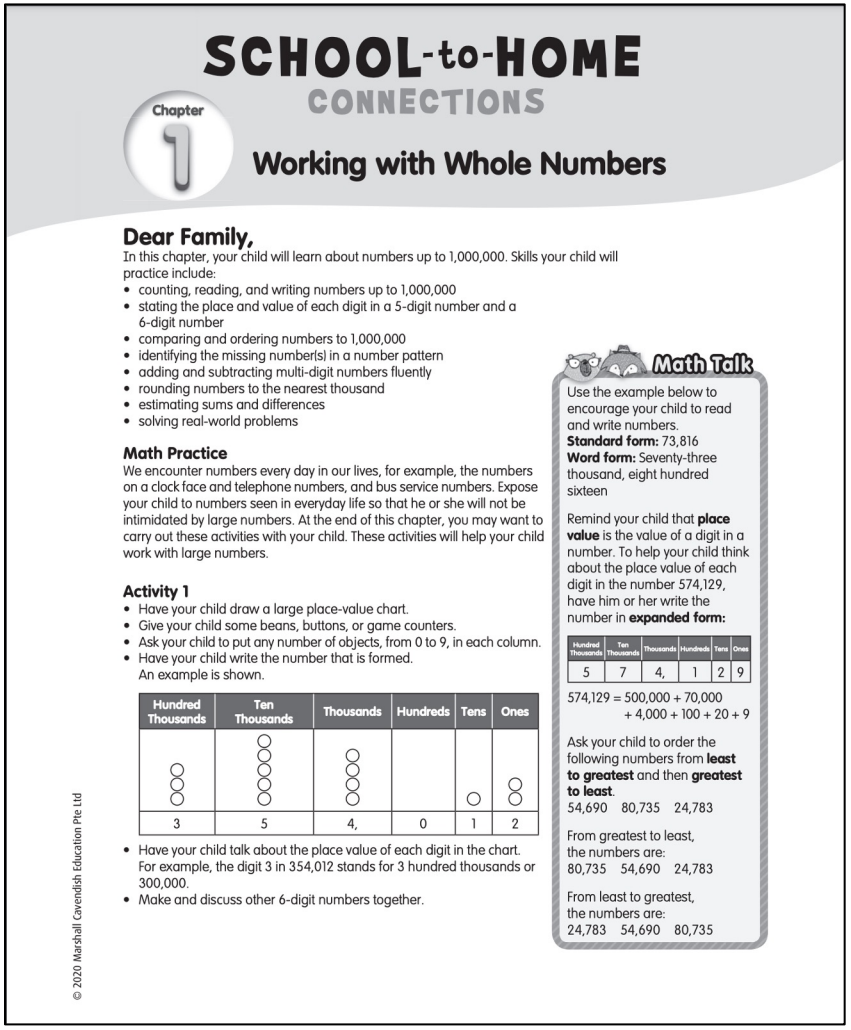


Support visualization at home

https://www.mathplayground.com/thinkingblocks.html







SCHOOL-to-HOME CONNECTIONS

Chapter 1

Working with Whole Numbers

Dear Family,

In this chapter, your child will learn about numbers up to 1,000,000. Skills your child will practice include:

- counting, reading, and writing numbers up to 1,000,000
- stating the place and value of each digit in a 5-digit number and a 6-digit number
- comparing and ordering numbers to 1,000,000
- identifying the missing number(s) in a number pattern
- adding and subtracting multi-digit numbers fluently
- rounding numbers to the nearest thousand
- estimating sums and differences
- solving real-world problems

Math Practice

We encounter numbers every day in our lives, for example, the numbers on a clock face and telephone numbers, and bus service numbers. Expose your child to numbers seen in everyday life so that he or she will not be intimidated by large numbers. At the end of this chapter, you may want to carry out these activities with your child. These activities will help your child work with large numbers.

Activity 1

- Have your child draw a large place-value chart.
- Give your child some beans, buttons, or game counters.
- Ask your child to put any number of objects, from 0 to 9, in each column.
- Have your child write the number that is formed.
  An example is shown.

Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
○○○	○○○○○	○○○○		○	○○
3	5	4,	0	1	2

- Have your child talk about the place value of each digit in the chart. For example, the digit 3 in 354,012 stands for 3 hundred thousands or 300,000.
- Make and discuss other 6-digit numbers together.

Math Talk

Use the example below to encourage your child to read and write numbers.
Standard form: 73,816
Word form: Seventy-three thousand, eight hundred sixteen

Remind your child that **place value** is the value of a digit in a number. To help your child think about the place value of each digit in the number 574,129, have him or her write the number in **expanded form:**

Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
5	7	4,	1	2	9

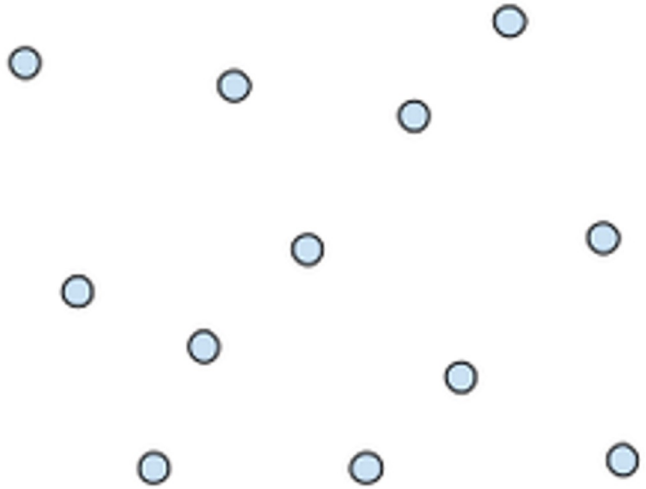
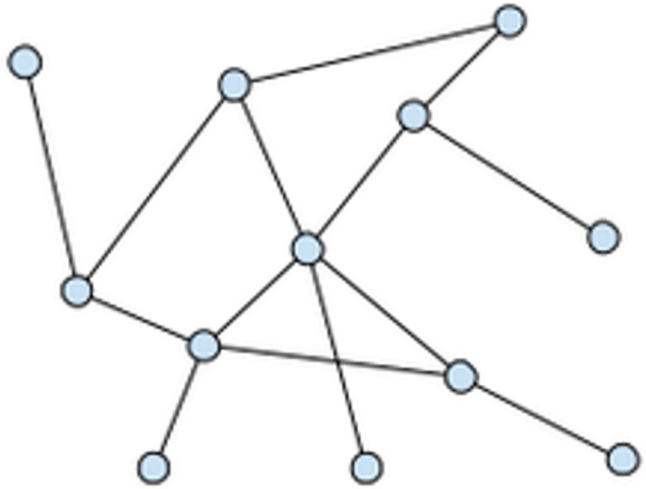
574,129 = 500,000 + 70,000 + 4,000 + 100 + 20 + 9

Ask your child to order the following numbers from **least to greatest** and then **greatest to least.**
54,690 80,735 24,783

From greatest to least, the numbers are:
80,735 54,690 24,783

From least to greatest, the numbers are:
24,783 54,690 80,735

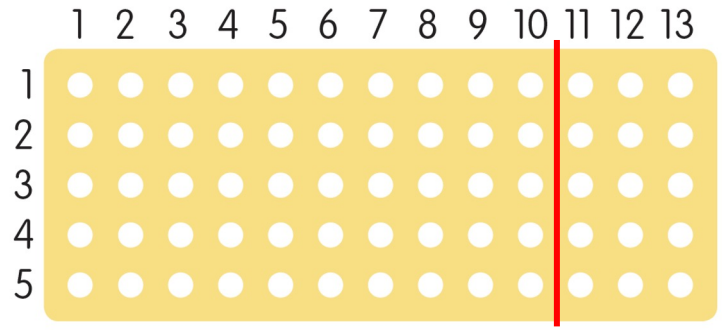
Variation

Instrumental Understanding	Relational Understanding
	

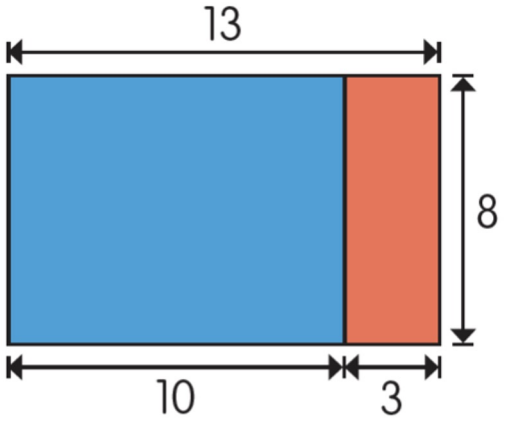
Skemp

Perceptual Variation

1 $13 \times 5 = ?$



2 $13 \times 8 = ?$



$$13 \times 8 = (10 \times 8) + (3 \times 8)$$
$$= 80 + 24$$
$$= 104$$

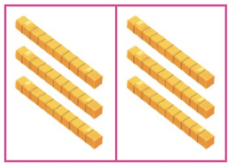
Numerical Variation

LEARN Multiply by tens or hundreds

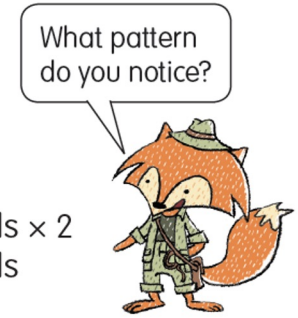
1 What is 3 × 2?

3 × 2 = 3 ones × 2
= 6 ones
= 6

What is 30 × 2?



30 × 2 = 3 tens × 2
= 6 tens
= 60



What is 300 × 2?

300 × 2 = 3 hundreds × 2
= 6 hundreds
= 600

1 What is 23 × 300?

23 × 300
= (23 × 3) × 100
= 69 × 100
= 6,900

$$\begin{array}{r} 23 \\ \times\ 3 \\ \hline 69 \end{array}$$

2 What is 120 × 400?

120 × 400
= (120 × 4) × 100
= 480 × 100
= 48,000

$$\begin{array}{r} 120 \\ \times\ 4 \\ \hline 480 \end{array}$$

3 What is 41 × 2,000?

41 × 2,000
= (41 × 2) × 1,000
= 82 × 1,000
= 82,000

$$\begin{array}{r} 41 \\ \times\ 2 \\ \hline 82 \end{array}$$

4 What is 304 × 2,000?

304 × 2,000
= (304 × 2) × 1,000
= 608 × 1,000
= 608,000

$$\begin{array}{r} 304 \\ \times\ 2 \\ \hline 608 \end{array}$$

Support Variation at home

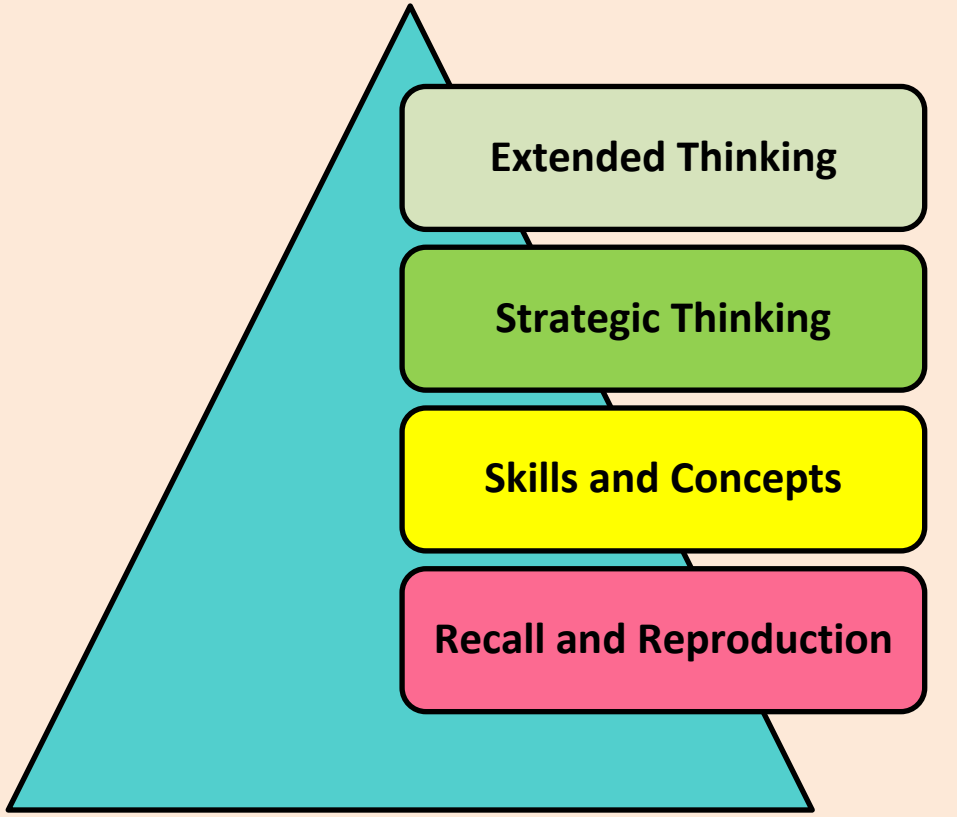
Play Games:

Azul
Oshi
Evolution
Mancala
Chess
Ken - Ken
Othello
SET
Escape Rooms

Do Activities:

Geocaching
Cut a Recipe in Half
Make a Mosaic
Sew
Music
Organize Cabinets by different attributes
Find patterns in nature

Constructing Meaning For Yourself



Webb's Depth of Knowledge

Grade	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade
Strategy						
Act It Out	X	X				
Draw a picture	X	X				
Look for patterns	X	X	X	X	X	X
Make a systematic list	X	X	X	X	X	X
Guess and check		X	X	X	X	X
Draw a picture/model/bar model/diagram			X	X	X	X
Work backwards			X	X	X	X
Solve part of a problem				X	X	X
Simplify the problem				X	X	X
Tabulating					X	X
Make supposition					X	X
Use before-after concept					X	X
Restate the Problem						X
Use a formula/equation						
Considering special cases						

5
quick ways
ask better
questions

1. Plurals
   "some ways"

2. Tentative Language
   "might" or "some" or "could"

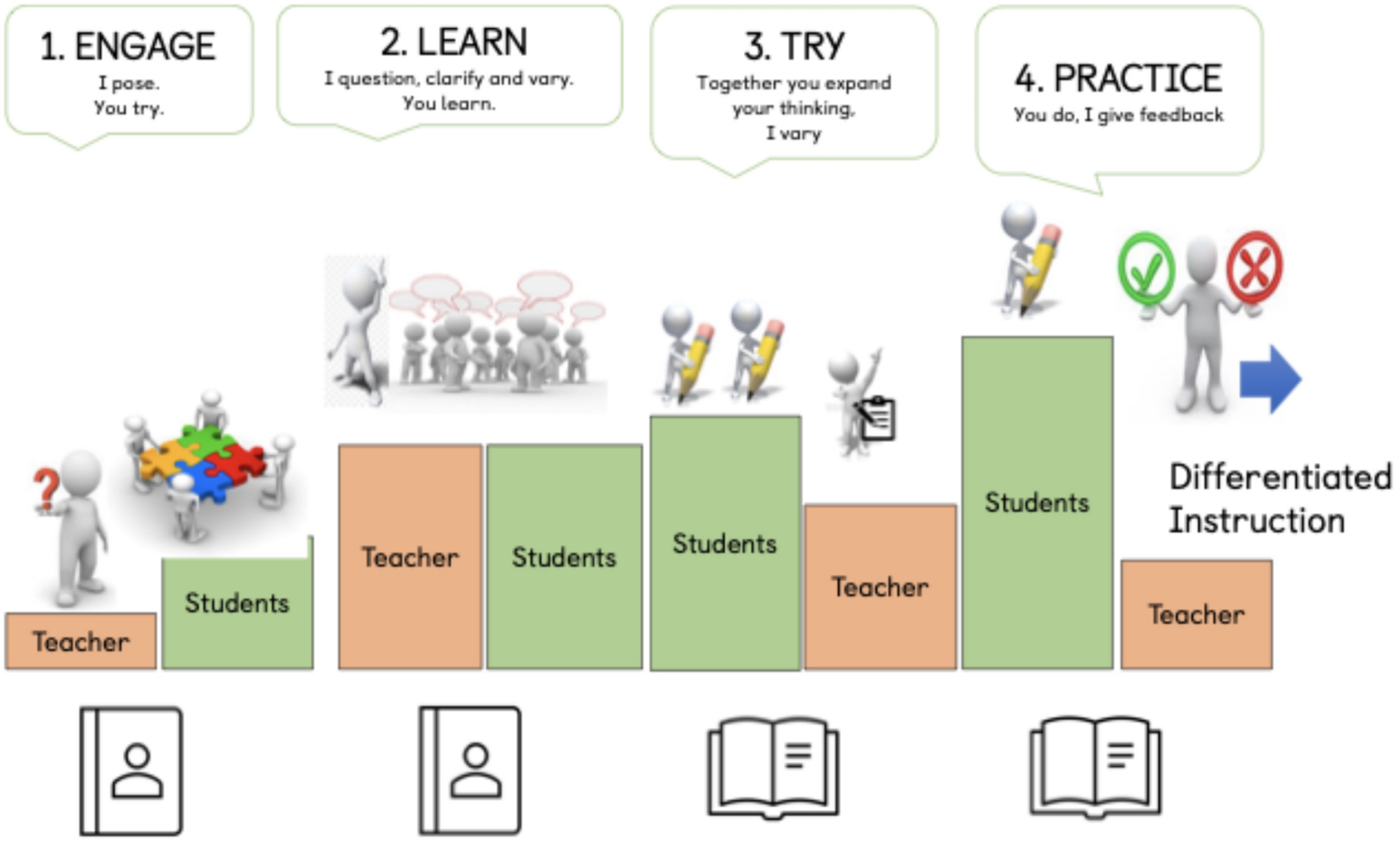
3. Open – ended questions

4. Verbs for higher order thinking
   "compare" "predict" "evaluate"

5. Presume that they know.
   "When you noticed the pattern…
   what did you see?"

Based on Bay-Williams and McGatha (2014)

Lesson Structure



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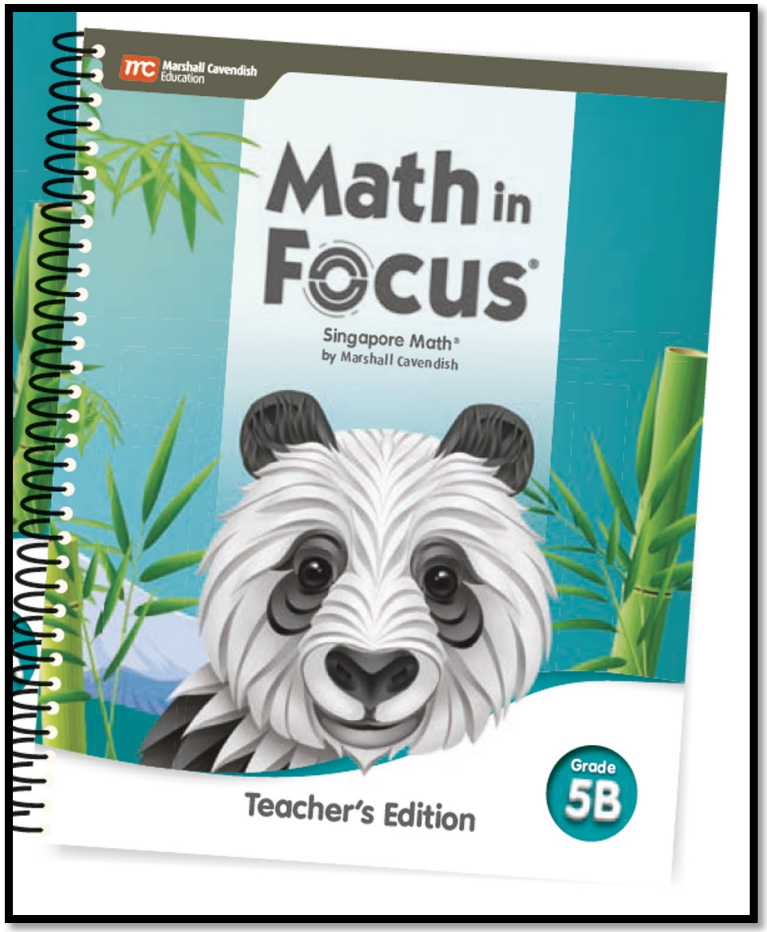

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