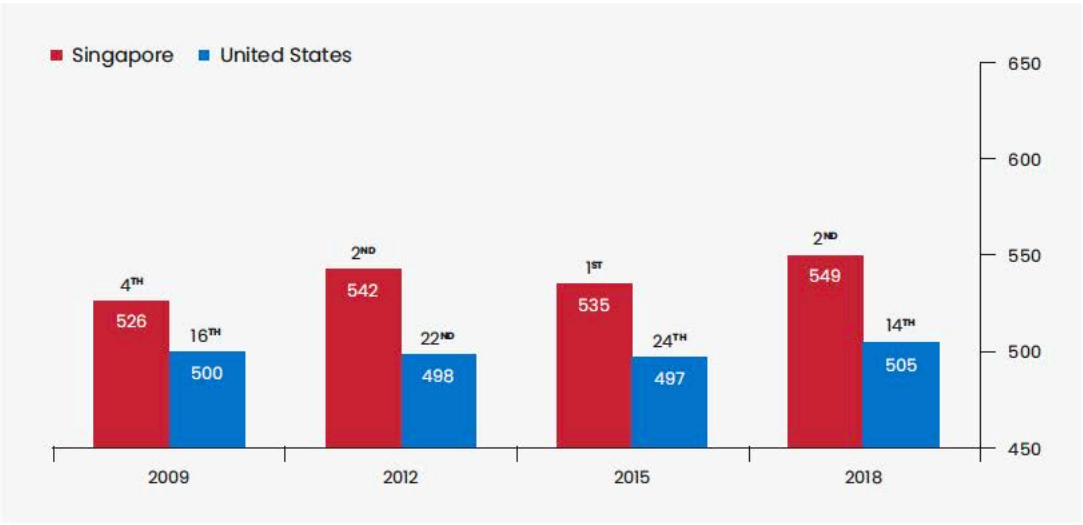


**TABLE 2 ▲**  
TIMSS 8th grade mathematics scores and rankings of Singapore and U.S. (Data source: TIMSS & PIRLS International Study Center)

PISA, on the other hand, is a triennial assessment to test 15-year-old students in reading, mathematics, and science and is organized by the Organisation for Economic Co-operation and Development (OECD). Singapore is not a country in the OECD but has been highly ranked in all categories in every cycle of PISA since its first participation in 2009.

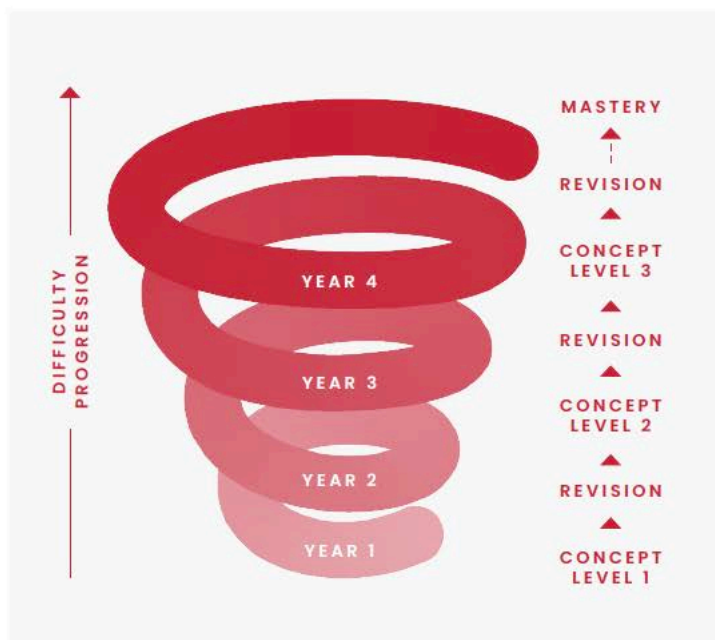
**TABLE 3 ▼**  
PISA reading scores and rankings of Singapore and U.S. (Data source: OECD)



to deepen their understanding of addition, as well as perform more challenging calculations.

FIGURE 2 ►

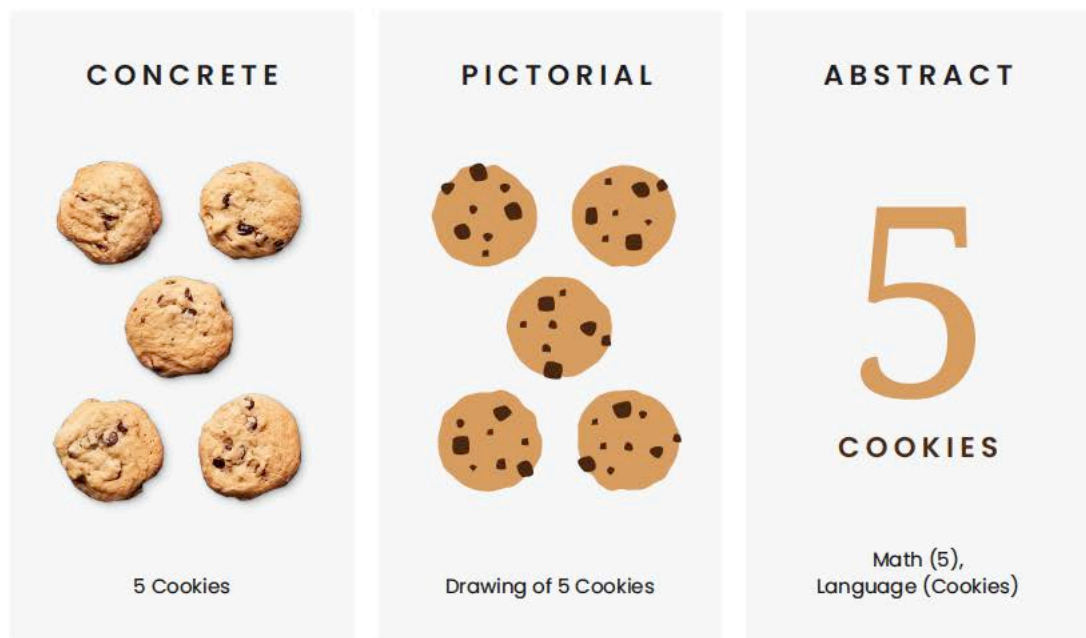
Singapore's spiral curriculum approach



SG Math isn't the only math curriculum using a spiral model. In fact, a lot of math (and other subject) curriculums in the U.S. and around the world adopt this approach. What makes Singapore's spiral curriculum unique is that the topical framework for each grade level is age-appropriate and that all concepts introduced are interconnected, building a solid foundation for the next. This means that children are never expected to grasp concepts that are too advanced or too abstract for them. Instead, their knowledge is built systematically, layer by layer.

Unfortunately, because of how the topics are organized in the curriculum, Singapore's approach is often misconstrued as the opposite of a spiral curriculum in the U.S., especially when discussed in comparison to American math curricula such as *Everyday Mathematics* and *Saxon Math*.

child has added the word to their vocabulary and is able to use it freely.



**FIGURE 3** ▲  
Concrete-pictorial-  
abstract progression

SG Math is one of the few math curricula in the world that has applied CPA extraordinarily well by capitalizing on and prolonging the pictorial stage with bar model representations. Bar models are also known as the Model Method which, as we will see below, is a visual tool developed to help students solve word problems and strengthen conceptual understanding through pictorial representations.

#### KEY FEATURE 1

### The Model Method

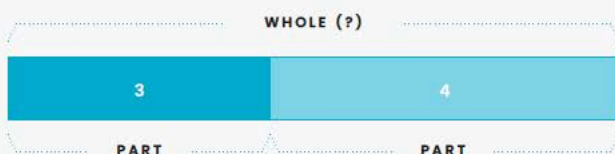
The Model Method is the crown jewel of Singapore's math curriculum. If you search for SG Math online, chances are the majority of articles will mention the Model Method as the distinguishing feature of the curriculum. If you recall, this method is a relatively

## Part-whole models

The part-whole model is used to illustrate situations when the whole is made up of different parts. It is a fantastic way to teach number bonds in lower grades because it visually represents the concept that a number can be made of up two or more smaller numbers. Addition and subtraction are also concepts that bar models can teach effectively.

### ADDITION PROBLEM EXAMPLE

Allison has 3 cookies. Her brother, Alan, has 4 cookies. How many cookies do they have altogether?



Part + Part = Whole  
 $3 + 4 = 7$

### SUBTRACTION PROBLEM EXAMPLE

Jacob has \$10. He used \$2 to buy a pen. How much money does he have left?



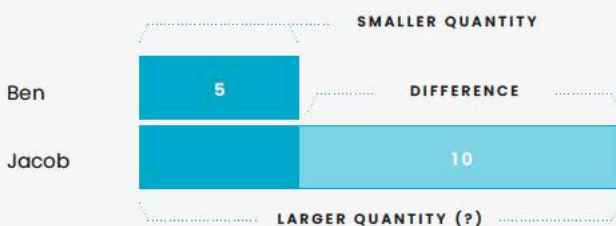
Whole – Part = Part  
 $\$10 - \$2 = \$8$

## Comparison models

Comparison models demonstrate the relationship between two or more quantities when they are compared to show their differences. In lower grades, the comparison model is employed to teach relative quantities such as greater than, smaller than, biggest, and smallest, as well as word problems involving addition and subtraction.

### ADDITION PROBLEM EXAMPLE

Ben has 5 books. Jacob has 10 more books than Ben. How many books does Jacob have?



Smaller Quantity + Difference = Larger Quantity  
 $5 + 10 = 15$

### SUBTRACTION PROBLEM EXAMPLE

Allison has 3 cookies. Her brother, Alan, has 20 cookies. How many more cookies does Alan have than Allison?

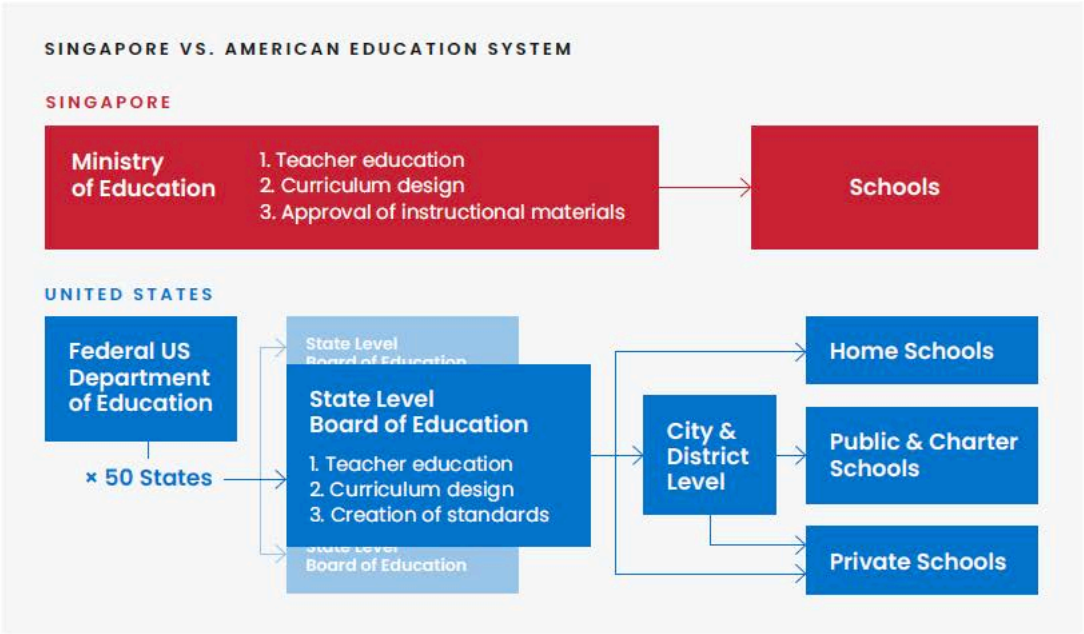


Larger Quantity – Smaller Quantity = Difference  
 $20 - 3 = 17$

same way that traditional public schools are. Public school districts are often subjected to budget cuts, especially after President George W. Bush’s No Child Left Behind (NCLB) Act, which allocates funding according to the student test scores in each school.

The issue of privatization in the American education system is only one of many that are widely debated, and there seems to be no consensus on what the solutions should be. The decentralized nature of the American system results in multiple, and often conflicting, visions of how children should be educated. This polarity in views is also apparent in the actions of parents and educators when they choose the kind of curriculum to implement.

**FIGURE 8** ▼  
Singapore vs. American Education System



The state of mathematics education in the U.S. parallels its education system. The only semblance of a national mathematics curriculum is the standards published by the National Council of Teachers of

stand what manipulatives are. Manipulatives are concrete objects that children can manipulate with their hands to better understand abstract concepts through visual, hands-on learning. Because many mathematical concepts are very abstract, manipulatives make math more tangible, especially to young children. The good news is that there are no set criteria for what constitutes a manipulative, so you can literally use anything and everything.

Instead of using counters to teach children addition and subtraction, you can use a pack of M&M's and achieve the same results. One potential scenario could be children counting the total number of M&M's they take out of a packet. Another scenario could be sorting the chocolate pieces into different colors and counting how many M&M's there are in each color. There are endless scenarios you can come up with, and you can do this for 5-10 minutes every day. If you don't want to use M&M's, you can also use paper cups, pencils, pens, cookies, books - whatever you can get your hands on. For me, the best part about using something edible is that you both get a treat after doing math!

Manipulatives sets specific to SG Math often include magnetic strips of different lengths for children to piece out bar models. If you find it hard to keep track of these strips neatly, you can easily simulate bar models without the magnetic strips. You can use pieces of paper that you are already planning to recycle and cut out equal pieces of rectangular strips from them. You can even make the rectangular strips with your child and turn craft time into a math lesson! An added bonus for including the child is that you can teach them how to measure out equal lengths using a ruler and how to divide a piece of paper up into multiple strips.

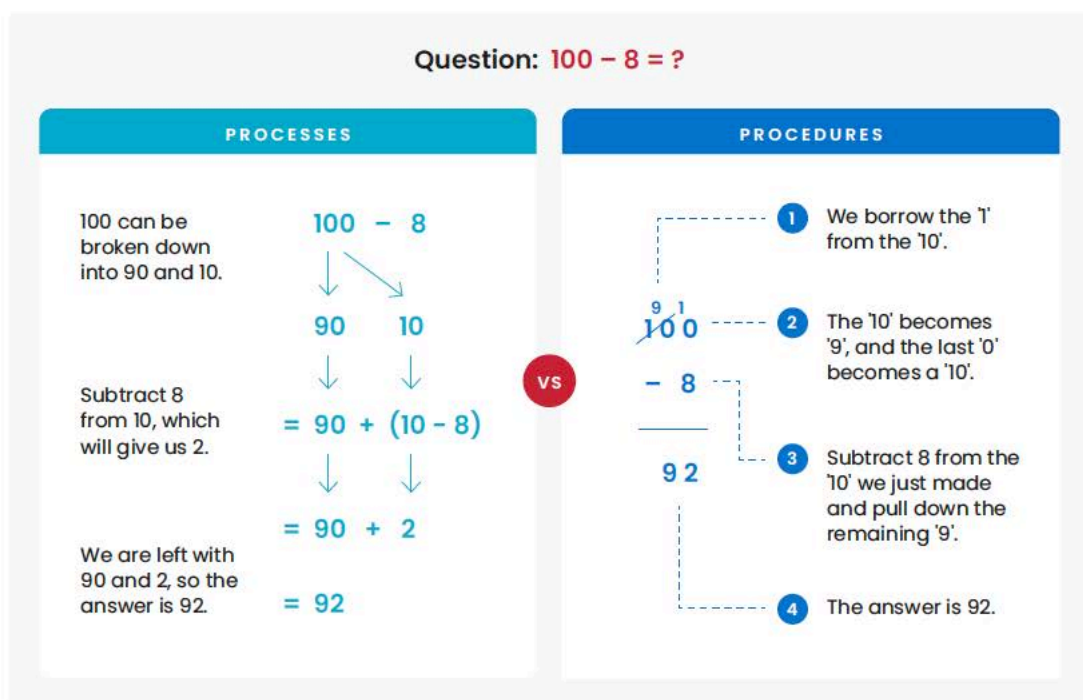
## TAKEAWAY 3

## Emphasize problem-solving processes

Processes are a key component of the SG Math framework but often get overlooked when the curriculum travels outside of Singapore. Many of us also tend to use mathematical processes and procedures interchangeably because we show our thinking process by writing down the appropriate steps and procedures to get to a mathematical solution. While processes and procedures may look the same on paper, they are two interrelated, yet very different, elements. According to the International Organisation for Standardisation (ISO), processes are “interrelated or interacting activities which transform inputs into outputs,” whereas procedures are a specific way to “carry out an activity or a process.”<sup>63</sup> The difference between processes and procedures in the context of math is illustrated in Figure 13.

FIGURE 13 ▼

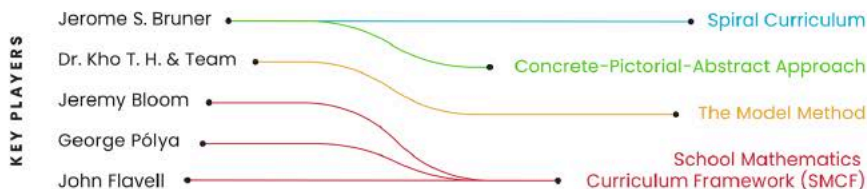
Processes vs. procedures



# THE SECRETS TO SINGAPORE'S WORLD-CLASS MATH CURRICULUM

SUMMARIZED

## KEY INFORMATION



## MYTHS

- 1 SG Math is not a spiral curriculum
- 2 I must buy manipulatives to use SG Math
- 3 I have to follow exactly the structure of all instructional materials
- 4 The Model Method is the only way to solve problems in SG Math
- 5 SG Math looks so simple that children can learn it on their own.

## TAKEAWAYS

- 1 Invest in elementary mathematics education
- 2 A logically and coherently structured mathematics curriculum is key
- 3 Emphasize problem-solving processes
- 4 Procedures are important, but they do not have to be memorized
- 5 Practice, practice, practice!
- 6 Integrate test-taking techniques in math lessons
- 7 Develop children's mathematical mindsets
- 8 Commit to a curriculum and stay flexible

## WHAT CAN WE DO?

- 1 Do more research
- 2 Invest in instructors
- 3 Drawing bar models is not an option; it's a necessity
- 4 Open up the problem-solving process
- 5 Focus on processes and teach error analysis
- 6 Engage children in your teaching
- 7 Encourage children to discuss math
- 8 Make connections between different topics
- 9 Expect children to do well in math
- 10 Let children apply concepts in different contexts