

## An Overview of the Singapore Math Texts

Dr. Richard Bisk

Chair and Professor of Mathematics

Worcester State College

508-929-8962

Email: [rbisk@worchester.edu](mailto:rbisk@worchester.edu)

Web Site: [wwwfac.worcester.edu/smip/](http://wwwfac.worcester.edu/smip/)

**Why Singapore Math?** – A few comments from a mathematician.

When I teach, at any level, the **key question is always why?**

I started using Singapore Math in professional development courses in 2000 as a vehicle to connect teacher knowledge of mathematical content with elementary and middle school student work. The biggest challenge we face in improving K-8 mathematics instruction is teacher content knowledge of the subject. We would never be satisfied if our third grade teachers read at the sixth grade level. But we have accepted that many operate mathematically at the sixth grade level. This is not meant to be a criticism of teachers; but rather of some of our teacher training programs and state departments that license teachers. Many elementary school teachers will readily admit that they don't feel comfortable with mathematics. I believe that teacher content knowledge is critical and see the Singapore Math books as a vehicle for improving it. I also suspect that it's the best elementary textbook series around.

How do you teach a mathematical subject when you aren't proficient in it? You focus on rules, procedures and memorization; or on manipulatives, games and activities that you can't readily connect to concepts. (I should note that none of these things are bad if done appropriately.) When I work with teachers or students, the overriding point that I want to get across is the importance of understanding whatever mathematics you are doing. When you resort to teaching or learning by memorization only, nothing is being taught or learned. The focus on understanding is implicit in the Singapore Math books.

In the current Math Wars, we often see two positions about elementary mathematics; reform and traditional. Many see these positions as diametrically opposed; traditional focuses on basic skills; while reform emphasizes conceptual understanding. But a student who understands place value should have no difficulty multiplying two 2 digits numbers. I want students to memorize their times tables; but to do the memorization with understanding. Then when they can't remember what  $6 \times 8$  equals; they might think: "I know that  $5 \times 8 = 40$ . So one more 8 is 48." Or they might think: "I know that  $3 \times 8 = 24$ . To get  $6 \times 8$ , I need to double that result." These are just two of the many areas where basic skills and conceptual understanding support each other.

The Singapore books do an excellent job of teaching for understanding and emphasizing the importance of basic skills.

## TIMSS 2003 – Average Mathematics Scaled Scores by Country

Fourth grade		Eighth grade	
Country	Average score	Country	Average score
<b>International average</b>	<b>495</b>	<b>International average</b>	<b>466</b>
Singapore	594	Singapore	605
Hong Kong SAR <sup>1,2</sup>	575	Korea, Republic of	589
Japan	565	Hong Kong SAR <sup>1,2</sup>	586
Chinese Taipei	564	Chinese Taipei	585
Belgium-Flemish	551	Japan	570
Netherlands <sup>2</sup>	540	Belgium-Flemish	537
Latvia	536	Netherlands <sup>1</sup>	536
Lithuania <sup>3</sup>	534	Estonia	531
Russian Federation	532	Hungary	529
England <sup>2</sup>	531	Malaysia	508
Hungary	529	Latvia	508
United States <sup>2</sup>	518	Russian Federation	508
Cyprus	510	Slovak Republic	508
Moldova, Republic of	504	Australia	505
Italy	503	United States	504
Australia <sup>2</sup>	499	Lithuania <sup>3</sup>	502
New Zealand	493	Sweden	499
Scotland <sup>2</sup>	490	Scotland <sup>1</sup>	498
Slovenia	479	Israel	496
Armenia	456	New Zealand	494
Norway	451	Slovenia	493
Iran, Islamic Republic of	389	Italy	484
Philippines	358	Armenia	478
Morocco	347	Serbia <sup>3</sup>	477
Tunisia	339	Bulgaria	476

Additional countries with 8<sup>th</sup> grade scores below Bulgaria's are included in the complete study. Hence the average of 466.

## HOW IS SINGAPORE MATH DIFFERENT?

1. Greater Depth/Less Breadth – More time is spent on each topic. Fewer topics are covered in a year. Greater emphasis on mastery.
2. More multi-step problems. Problems often require the use of several concepts. “Word problems” are more varied.
3. Review of concepts is not explicitly incorporated into the curriculum. Students are expected to have mastered a concept once it has been taught.
4. A higher level of expectation is implicit in the curriculum.
5. Probability is not included in the K-8 curriculum.\*

\*Easy to supplement. Amount of probability in many U.S. texts is minimal

---

## CHARACTERISTICS OF SINGAPORE PRIMARY MATHEMATICS\*

1. Problem Solving Emphasis. Use of model drawing process.
2. Focus on conceptual understanding. Use of Mental Math techniques to promote understanding.
3. Absence of Clutter and Distraction. Presentation is clean and clear and uses simple, concise explanations.
4. Coherent Development. Topics are introduced with simple examples and then incrementally developed until more difficult problems are addressed.
5. Concrete – Pictorial – Abstract Approach
6. Teacher and Parent Friendly. Since mathematical content is clear, it is often easier for teachers to plan lessons. Parents can read the books and help children.

**The focus on mathematics also makes clear the importance of teacher content knowledge.**

\* 3-6: From Parker – “Elementary Mathematics for Teachers,” 2003

## MENTAL MATH

Emphasizes an understanding of place value and the distributive, commutative and associative properties

- **Rearranging**

$$2 \times 387 \times 5 = (2 \times 5) \times 387$$

$$256 \times 4 = (250 \times 4) + (6 \times 4)$$

- **Compensation**

$$99 + 28 = 99 + (1 + 27) = (99 + 1) + 27$$

$$72 - 59 = 73 - 60 \quad \text{Add 1 to each}$$

$$50 \times 18 = 50 \times (2 \times 9) = (50 \times 2) \times 9$$

$$2300 \div 50 = 4600 \div 100 \quad \text{Double each}$$

- **Multiplying or Dividing by 4, 5, 8, 9, 25**

Multiply by 4 – Double twice:  $26 \times 4$

Divide by 4 – Halve twice:  $184 \div 4$

Multiply by 5 – Halve and multiply by 10:  $62 \times 5$

Divide by 5 – Divide by 10 and double:  $142 \div 5$

Multiply by 9 – Multiply by 10 and subtract the original number:

$$35 \times 9 = (35 \times 10) - (35 \times 1)$$

Multiply by 25 – Quarter and multiply by 100:

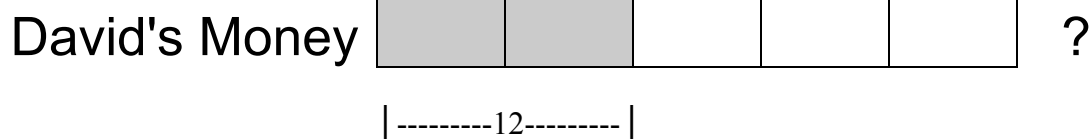
$$48 \times 25 = 48 \times \left(100 \times \frac{1}{4}\right) = \left(48 \times \frac{1}{4}\right) \times 100 = 12 \times 100$$

## MODEL DRAWING

Problem solving is one of the key components of the curriculum. The model drawing approach takes students from the concrete to the abstract stage via an intermediary pictorial stage. Students create bars and break them down into “units.” Students learn to use this strategy in the primary grades and continue with it throughout the program. The problems below involve fractions and percents and can be solved using model drawing. The grade levels are shown in parentheses to indicate the level of expectation of the curriculum. Additional problems and selected solutions are available on the web site.

- (3) The sum of two numbers is 36. The smaller number is one-third the larger number.
    - What is the smaller number?
    - What is the larger number?
  - (4) David spent  $\frac{2}{5}$  of his money on a storybook. The storybook cost \$12. How much money did he have at first?
  - (5) Tyrone bought a bag of marbles.  $\frac{1}{4}$  of the marbles was blue,  $\frac{1}{8}$  was green, and  $\frac{1}{5}$  of the remainder was yellow. If there were 36 yellow marbles, how many marbles did he buy?
  - (6) Cody’s monthly salary was increased by 5% this year. His monthly salary before the increase was \$1400. Find his monthly salary after the increase.
  - (7) Ali spent \$3 less than  $\frac{3}{5}$  of his money on a book and \$3 more than  $\frac{3}{4}$  his remaining money on a pen. He still had 50 cents left. Which items cost more between the book and the pen?
  - (8) In an election, there were two candidates. Candidate A received 65% of the votes cast and secured 2,400 votes more than candidate B. How many people voted?
- 

### Solution to problem 2



$$\begin{aligned}2 \text{ units} &= 12 \\1 \text{ unit} &= 6 \\5 \text{ units} &= 30\end{aligned}$$

David started with \$30.

## TEACHERS COMMENTS

“I never realized that I do not understand math until I had to teach mathematics from the Singapore textbooks.”

---

“Topics are taught for mastery. Fewer topics taught in greater depth. Review is usually done in the context of a new topic or through use of word problems. Emphasizes logic and visualization.”

---

“... mastery of basic algorithms is expected in the early grades.... The students also learn why certain formulas are used rather than just learn how to apply the formulas. The most valuable aspect of Singapore Math is that the program encourages active thinking and emphasizes the communication of math ideas.”

“My biggest concern is the inclusion students. Some can barely keep up with a program that is geared towards for the average student. What is going to happen to them when they are placed in a program that is at a much higher level?”

“I firmly believe that we need to set the level of achievement high so students will rise to this challenge and achieve to their maximum potential.”

(grade 2 teacher)

---

“... Singapore Math has a strong problem solving component. The problems are not just computational exercises embedded in a simple context. They require students to build on past skills, as well as newly learned ones, in order to develop strategies to solve them.”

(grade 3 teacher)

---

“Concepts and skills are presented in challenging real world situations with an emphasis on thinking skills.”

“... textbooks are simple in language without many graphics.”

“Students are expected to know number facts. Those who don't have tremendous difficulty with complex problems. Teaches multiple skills simulataneously.”

(grade 4 teacher)

---

Begins by describing the program as “...no frills, back to basics.”

“Because of this simplistic design the student is able to maintain focus on the objective of the lesson. In many other textbooks the student is overstimulated.”

“Due to the design of the textbook of the textbook, discussion is encouraged and often times inevitable.”

The program “...encourages students to go beyond the basics and think.”

(grade 5 teacher)