

PREFACE:
Teacher's Guide for
Primary Mathematics (Singapore)

Why is a private, non-governmental U.S. organization like the Rosenbaum Foundation creating American Teacher's Guides for a foreign country's proprietary mathematics books? Because the Foundation believes that Singapore's *Primary Mathematics* books are the best elementary school math books available in English.

Once upon a time, acquisition of the beginning steps in arithmetic was taken for granted. These days, children's school attendance no longer guarantees children's learning. U.S. students' failure to come in Number One In The World In Mathematics (TIMSS, the Third International Study of Science and Mathematics) became a national obsession. School math is now discussed daily in editorials, on radio and television, and even in the halls of Congress.

According to TIMSS, our 4th graders rank only a bit above world average in math. That's hard on our ambitions for our children. Even harder to take: the U.S. dropping further at 8th grade, from above to below average.¹ It seems that the longer our children are in school, the lower their math sinks in comparison to world level. Meantime, the coveted Number One position at both 4th and 8th grade is held instead by Singapore.

TIMSS data establishes more than countries' ranking: it also pinpoints their math learning factors - both in success and in failure: teacher proficiency/lack in mathematics, coupled with quality of the school math curriculum². Accordingly, national concern brought a flurry of reform efforts: development of and experimentation with new math programs, textbooks and pedagogy. So far however the follow-up international study, TIMSS-R, shows no improvement in U.S. students' world standing.

Working with the professional mathematics community led the Rosenbaum Foundation to focus, not on reform experimentation, but on identifying those teaching materials and pedagogical practices that already have a solid, proven record of success. The mathematicians determined that the school math of Japan, China, Singapore, Korea, the former Soviet Union and a number of the small East European countries are all excellent. Further, Singapore's existing English language school math materials were found as good as their students' first place TIMSS standing would suggest.

The central idea of all of mathematics is to discover how it is that knowing some few things will, via reasoning, permit us to know much else - without having to commit the new information to memory as separate facts. Mathematics is economy of information, not its unnecessary proliferation. Basic mathematics properly presented conveys this lesson. It is the connections, the reasoned, logical connections, that make mathematics manageable. Understanding the structure of mathematics is the key to success. Everyone can be "good at mathematics", and this series, as has been proved in Singapore, shows how. These Singapore textbooks lead the student from the vocabulary of counting, shape and position, through the famous pitfalls of Word Problems (story problems), to the beginnings of algebra and geometry.

Singapore's Primary Mathematics books are paper-bound, small and light. They are clearly printed, and include enough exercises in the text to supply model explanations of new topics as they come up. Each new topic becomes enriched by new connections with other parts of mathematics and applications of greater difficulty. What is taught in the textbook, and as explained by the teacher or discussed with a class as a whole, is further reinforced with the Singapore workbook's rich supply of exercises for students to do on their own. These deceptively thin texts were created with an impressive understanding of how children actually learn. For first grade, this involves subtleties like addition being made well understood before the word addition is introduced. Work with number bonds (combinations of numbers that can make up a given number) builds a life-long familiarity and comfort with arithmetic processes.³

The role of this Teacher's Guide is to be the helpful interface between curriculum and classroom. How much can best be covered in one day's math class? What variants work best when introducing a new topic? How to engage students individually and as a group? How to expand and reinforce the lesson, when and how to review? The operative word is "Guide", since every teacher prepares his/her own daily lessons.

For our American Teachers' Guide to be effective, it must convey the Singapore excellencies into the American teaching and learning environment. The Foundation was fortunate to engage the participation of Professor W. A. M. Alwis of The National University of Singapore as primary author. Dr. Alwis, partly on his University's behalf and largely by his own preference, works closely with many of Singapore's schools, teachers and students. Dr. Alwis has worked equally well with the Foundation's own Mathematics Advisory Board, which includes members of the National Academy of Sciences as well as recipients of a Presidential Science Medal and a MacArthur "genius" Award.

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¹ By 12th grade, U.S. students ranked at the world bottom in math. Singapore students, who came in first at the 4th and 8th grades, did not take part in the 12th grade TIMSS project. Since Singapore elementary school is K-6, followed by 4 years of high school, Singapore students are already out of high school when our students still have two more years to go.

²The U.S. curriculum has (unfortunately justly) been described as "a mile wide and an inch deep".

³Singapore's kindergarten/pre-school books familiarize children with numbers, with some addition, and even beginnings of one-to-one correspondence. First grade therefore can begin past that, with counting.