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New AIR Study Compares the Quality of U.S. Math Instruction with Singapore, a Recognized World Leader

U.S. Trails, But Both Nations Could Learn from Each Other

WASHINGTON, D.C. — A study by the American Institutes for Research comparing the teaching of elementary school mathematics in the United States and Singapore has found that Singapore's textbooks and assessment examinations are more demanding and their teachers more skilled mathematically but that U.S. approaches often put more emphasis on certain important 21st century math skills.

Funded by the U.S. Department of Education, the study *What the United States Can Learn From Singapore's World-Class Mathematics System (and what Singapore can learn from the United States)* identified major differences between the mathematics frameworks, textbooks, assessments, and teacher preparation in both countries.

Singapore is a recognized leader in mathematics achievement. Singaporean students ranked first in the world on the Trends in International Mathematics and Science Study-2003, while U.S. students ranked 16th out of the 46 participating nations. Scores for U.S. students were among the lowest of all industrialized countries.

“It is unreasonable to assume that Singaporean students have mathematical abilities inherently superior to those of U.S. students; rather, there must be something about the system that Singapore has developed to teach mathematics that is better than the system we use in the United States. That's why it's important to take a closer look, and see how the U.S can learn and how the U.S can improve,” says Steven Leinwand, the lead AIR author. “And in the process, we came across some things Singapore might think about addressing. For example, the U.S. frameworks more often include high-order thinking skills critical to competing in the 21st century, though they are not obviously taught well enough here.”

The study also includes initial results from four pilot programs that used the Singapore mathematics textbook in place of their regular textbooks. The pilot programs involved students in Baltimore, Md., Montgomery County, Md., North Middlesex, Mass.,

and Paterson, N.J. The study found two pilot sites produced sizeable improvements in student outcomes, but overall the study observed mixed results because “the pilot sites, to varying degrees, encountered problems with teachers who lacked the educational preparation needed.” Student mobility also limited prior exposure to the Singapore mathematics curriculum, a serious problem in a curriculum that teaches to mastery and does not repeat content.

Singapore has a centralized educational system, with detailed and consistent implementation procedures that teach topics to mastery at each grade. In order to characterize the decentralized U.S. system, mathematics frameworks in seven states were examined: California, Florida, Maryland, New Jersey, North Carolina, Ohio and Texas.

Findings include:

Singapore Strengths

- **Framework:** The study indicates there is a correlation between focused frameworks such as those used in Singapore and good test performance. Singapore offers an alternative mathematics framework for lower-performing students that covers all the mathematics topics in the regular framework, but at a slower pace and with greater repetition, and with support from expert teachers.
- **Textbooks:** Singapore’s textbooks build deep understanding of mathematical concepts while traditional U.S. textbooks rarely get beyond definitions and formulas.
- **Teaching:** Singaporean elementary school teachers are required to demonstrate mathematics skills superior to those of their U.S. counterparts before they begin paid college training to become a teacher. They receive a high level of professional development training (100 hours) each year.
- **Assessment:** Singapore uses more challenging tests and utilizes a value-added approach that rewards schools for individual student progress over time.

U.S. Strengths

- **U.S. Strengths:** Although the U.S. mathematics program is weaker than Singapore’s in most respects, the U.S. system is stronger than Singapore’s in some areas. The U.S. frameworks give greater emphasis than Singapore’s to developing important 21st century mathematical skills such as representation, reasoning, making connections, and communication. The frameworks and textbooks also place greater emphasis on applied mathematics, including statistics and probability.

The researchers concluded that the “exploratory results have identified key differences between the U.S. and Singapore mathematics systems. These differences suggest potentially significant reforms that could improve the U.S. mathematics system, but these findings require further validation” from larger scientific studies.

AIR, founded in 1946, is a recognized leader in the behavioral and social sciences. It is a non-partisan, not-for-profit organization engaged in domestic and international research, development, evaluation, analysis, product development, training and technical assistance and assessment.

The full report, a state specific summary of results, and sample assessment comparisons are available on AIR’s Web site: www.air.org/news/default.aspx.

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