This issue of CREATE NEWS contains an overview of the results of the Third International Mathematics and Science Study (TIMSS) for middle-school students. A description of the TIMSS project and general international results are presented here in an article authored by researchers at the TIMSS International Study Center at Boston College. More specific information about the performance of U.S. middle-school students, teachers, and curricula follows the international overview.

Mathematics and Science Achievement in the Middle School Years: An International Perspective

ALBERT E. BEATON, MICHAEL O. MARTIN, INA V.S. MULLIS, EUGENIO I. GONZALEZ, THERESA A. SMITH, DANA L. KELLY

Since its inception in 1959, the International Association for the Evaluation of Educational Achievement (IEA) has conducted a series of international comparative studies designed to provide policymakers, educators, researchers, and practitioners with information about educational achievement and learning contexts. The Third International Mathematics and Science Studies (TIMSS) was the largest and most ambitious of these studies ever undertaken.

Forty-five countries collected data in more than thirty different languages. Five grade levels were tested in the two subject areas, totaling approximately 15,000 schools, and more than half a million students tested around the world. This review focuses on middle-school mathematics and science. Six content dimensions were covered in the TIMSS mathematics tests given to middle-school students—fractions and number sense; measurement; proportionality; data representation, analysis, and probability; geometry; and algebra. Five content dimensions were covered in the TIMSS middle-school science tests—earth science, life science, physics, chemistry, and environmental issues and the nature of science. One-third of all testing time was devoted to free-response questions that required students to generate and write their answers.

Because the home, school, and national contexts within which education takes place can play important roles in how students learn mathematics and science, TIMSS collected extensive information about such background factors. The students who participated...
completed questionnaires about their home and school experiences related to learning mathematics and science. Also, teachers and school administrators completed questionnaires about instructional practices. The following sections summarize the major findings for middle-school students in mathematics and science.

Students’ Mathematics and Science Achievement

- Singapore was the top-performing middle-school country in both mathematics and science. Korea, Japan, and Hong Kong also performed very well in mathematics, while the Czech Republic, Japan, and Korea performed well in science. Lower-performing countries in both mathematics and science were Colombia, Kuwait, and South Africa. Of the twenty-five countries that followed all TIMSS requirements, the United States scored below the international average of these countries in mathematics and below the average of these countries in science.
- Perhaps the most striking finding was the large difference in average achievement between top-performing and bottom-performing countries in both subject areas. Despite this large difference, when countries were ordered by average achievement, there were only small or negligible differences in achievement between top- and bottom-performing countries. Nonetheless, from beginning to the end of the rankings, there were substantial differences. For example, average achievement in top-performing Singapore was comparable to or exceeded performance for 95 per cent of students in the lowest-performing countries.
- For most countries, gender differences in mathematics were small or essentially nonexistent. However, what differences there were favored boys rather than girls. In most countries and internationally, boys had significantly higher mean science achievement than girls. This is attributable mainly to significantly higher performance by boys in the earth science, physics, and chemistry areas.
- Even though students in the top-performing countries had very high achievement on many of the mathematics test questions, students in most countries had difficulty with multistep problem solving and applications. For example, students were asked to draw a rectangle whose length was one and one half times the length of a given rectangle and whose width was half the width of that rectangle. In only two countries did at least half the students correctly draw the new rectangle. Students also generally found proportionality items difficult.

Student Attitudes Toward Mathematics and Science

- Within nearly every country, a clear positive relationship was observed between a stronger liking of mathematics and science and higher achievement. Even though the majority of students in nearly every country indicated they like mathematics and science to some degree, clearly not all students felt positive to these subject areas.