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SEARCH 

Asian Students at the Top in Math, Science Study

Boston College team releases latest report on global education

By PATRICIA DELANEY | DEPUTY DIRECTOR OF PUBLIC AFFAIRS

Students from Asian countries were top performers in math and science at both the fourth and eighth grade levels, according to the most recent reports of the Trends in International Mathematics and Science Study (TIMSS), released Tuesday by TIMSS directors Michael O. Martin and Ina V.S. Mullis of the Lynch School of Education.

The TIMSS 2007 study also showed Asian countries with the highest percentage of students reaching the Advanced International Benchmark, representing fluency on items involving the most complex topics and reasoning skills.

The United States was among the countries that performed above the TIMSS scale average score in all aspects of the study, the fourth in a continuing cycle of international mathematics and science assessments conducted every four years.

Conducted by researchers at BC's TIMSS & PIRLS International Study Center, TIMSS is one of the world's most influential global assessments of student achievement in math and science. With more than 60 participants and 425,000 students assessed, TIMSS 2007 also is the largest study of student math and science achievement in the world. Each country sampled approximately 4,000 students in 150 schools.

TIMSS data provide invaluable international benchmarks that can be used to help define world-class performance in mathematics and science at the middle or lower-secondary school level. Beyond comparisons in mathematics and science test scores, reports provide a wealth of information on educational policies and practices around the world, as well as on gender performance, home environment, curriculum and instructional approaches and teacher preparation in math and science.

"One of the great strengths of TIMSS is the ability to monitor progress in educational improvement over time," said Martin and Mullis. "Such trend information is crucial in helping policy makers understand the impact of decisions about investment in education, curricular reform, and initiatives to improve instruction."

Among the 2007 study's general findings, more countries showed improvement in 2007 than declines at the fourth grade, in both mathematics and science. Steady improvement since the first TIMSS in 1995 was shown by a range of countries. At the eighth grade, the pattern was less pronounced. Although close to a dozen countries showed improvements, most countries either showed little change or declined.

The study also found negligible differences in achievement between boys and girls at fourth-grade math and science in half the countries. But eighth-grade girls demonstrated higher achievement than boys, in more countries, especially in mathematics.

Hong Kong SAR and Singapore were the top performing countries in fourth-grade mathematics, followed by Chinese Taipei and Japan. Kazakhstan, the Russian Federation, England, Latvia, and the Netherlands also performed very well. In mathematics achievement at the eighth grade, Chinese Taipei, Korea, and Singapore were followed by Hong Kong SAR and Japan. There was a substantial gap in average mathematics achievement between the five Asian countries and the next group of four similarly performing countries, including Hungary, England, the Russian Federation, and the US.

In science, students from Singapore and Chinese Taipei were top performers at both grade levels. In the fourth grade, Singapore was the top performing country, followed by Chinese Taipei and Hong Kong SAR. Japan, the Russian Federation, Latvia, England, the US, Hungary, Italy, and Kazakhstan also performed very well. At the eighth grade in science, Singapore and Chinese Taipei again had the highest average achievement, followed by Japan and Korea. England, Hungary, the Czech Republic, Slovenia, Hong Kong SAR, and the Russian Federation also performed well.

In mathematics, remarkable percentages of students reached the Advanced International Benchmark. In particular, at the fourth grade, Singapore and Hong Kong SAR had 41 and 40 percent of their students, respectively, achieving at or above the mark; at the eighth grade, Chinese Taipei, Korea, and Singapore had 40 to 45 percent of their students achieving at or above it.

In science, the highest performing countries at the fourth grade — Singapore and Chinese Taipei — had 36 and 19 percent of their students, respectively, achieving at or above the Advanced International Benchmark. At the eighth grade, Singapore and Chinese Taipei had 32 and 25 percent of their students, respectively, achieving at or above the benchmark.

In both subjects, at both the fourth and eighth grades, the majority of students were taught mathematics by teachers in their 30s and 40s. Although about one fourth of the students internationally were taught by teachers 50 or older, relatively few students were taught by teachers younger than 30.

Supplying schools with teachers well prepared to teach mathematics and science appears to be an increasing problem, especially at the fourth grade. At the eighth grade, most teachers had studied mathematics or science and reported feeling very well prepared to teach the topics in the TIMSS assessment. In contrast, teachers at the fourth grade reported little specific training or specialized education, especially in science. Just half the students had teachers who reported feeling very well prepared to teach the TIMSS science topics.

For more information about the study or to download the reports, go to <http://timssandpirls.bc.edu>.

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Table 1. Average mathematics scores of fourth- and eighth-grade students, by country: 2007

Grade four		Grade eight	
Country	Average score	Country	Average score
TIMSS scale average	500	TIMSS scale average	500
Hong Kong SAR ¹	607	Chinese Taipei	598
Singapore	599	Korea, Rep. of	597
Chinese Taipei	576	Singapore	593
Japan	568	Hong Kong SAR ^{1, 4}	572
Kazakhstan ²	549	Japan	570
Russian Federation	544	Hungary	517
England	541	England ⁴	513
Latvia ²	537	Russian Federation	512
Netherlands ³	535	United States^{4, 5}	508
Lithuania ²	530	Lithuania ²	506
United States^{4, 5}	529	Czech Republic	504
Germany	525	Slovenia	501
Denmark ⁴	523	Armenia	499
Australia	516	Australia	496
Hungary	510	Sweden	491
Italy	507	Malta	488
Austria	505	Scotland ⁴	487
Sweden	503	Serbia ^{2, 5}	486
Slovenia	502	Italy	480
Armenia	500	Malaysia	474
Slovak Republic	496	Norway	469
Scotland ⁴	494	Cyprus	465
New Zealand	492	Bulgaria	464
Czech Republic	486	Israel ⁷	463
Norway	473	Ukraine	462
Ukraine	469	Romania	461
Georgia ²	438	Bosnia and Herzegovina	456
Iran, Islamic Rep. of	402	Lebanon	449



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Table 3. Average science scores of fourth- and eighth-grade students, by country: 2007

Grade four		Grade eight	
Country	Average score	Country	Average score
TIMSS scale average	500	TIMSS scale average	500
Singapore	587	Singapore	567
Chinese Taipei	557	Chinese Taipei	561
Hong Kong SAR ¹	554	Japan	554
Japan	548	Korea, Rep. of	553
Russian Federation	546	England ³	542
Latvia ²	542	Hungary	539
England	542	Czech Republic	539
United States^{3, 4}	539	Slovenia	538
Hungary	536	Hong Kong SAR ^{1, 3}	530
Italy	535	Russian Federation	530
Kazakhstan ²	533	United States^{3, 4}	520
Germany	528	Lithuania ²	519
Australia	527	Australia	515
Slovak Republic	526	Sweden	511
Austria	526	Scotland ³	496
Sweden	525	Italy	495
Netherlands ⁵	523	Armenia	488
Slovenia	518	Norway	487
Denmark ³	517	Ukraine	485
Czech Republic	515	Jordan	482
Lithuania ²	514	Malaysia	471
New Zealand	504	Thailand	471
Scotland ³	500	Serbia ^{2, 4}	470
Armenia	484	Bulgaria ⁷	470
Norway	477	Israel ⁷	468
Ukraine	474	Bahrain	467
Iran, Islamic Rep. of	436	Bosnia and Herzegovina	466

The Release of U.S. Report on Grade 12 Results From the Third International Mathematics and Science Study (TIMSS)
February 24, 1998

Statement of Pascal D. Forgione, Jr., Ph.D.,
U.S. Commissioner of Education Statistics
National Center for Education Statistics (NCES)

Today feels like graduation day for all of us who have spent the last few years working on the TIMSS study. The results of schooling in America are now in. Our most significant finding is that U.S. 12th grade students do not do well. When our graduating seniors are compared to the students graduating secondary school in other countries, our students rank near the bottom. This holds true in both science and math, and for both our typical and our top-level students.

How do we know this? Our 12th graders along with students in their last year of school in more than 20 countries were tested in 1995 as part of the Third International Mathematics and Science Study, better known as TIMSS. The results are included in this report, Pursuing Excellence: A Study of U.S. Twelfth-Grade Mathematics and Science Achievement in International Context. This is the third report from the study. Previous reports covered international comparisons of 4th graders and 8th graders.

In sheer quantitative terms, TIMSS is the world's largest, most comprehensive, and most rigorous international education comparison ever. In 1995, researchers tested the mathematics and science knowledge of more than half a million students in 41 countries at three grade levels—primary, middle, and end of secondary. This is far more than any previous study. TIMSS ensured that the participating students in each country were representative of its population -- this study is a fair evaluation.

Today we are here to present the results of TIMSS covering the end of secondary school. We actually gave four different tests to these students. In 21 countries, students were tested for general knowledge in mathematics and science. In addition, in 16 countries, advanced students were tested in physics and advanced mathematics. This study included largely the developed European countries, plus the U.S., Canada, Australia, and New Zealand. Asian countries chose not to participate.

TIMSS is not an assessment of other country's best students against our average students, but of the entire range of students in each country. While the percentage of young adults who complete secondary school in the U.S. once was significantly larger than the percentage in other countries, this is no longer the case. Today, similar proportions of young people are enrolled at the end of secondary schooling in most of these countries. Since some nations group their students into different types of schools with different graduation requirements, TIMSS assessed students in their last year in all types of schools and programs in all countries. This last grade ranged from the ninth grade in some vocational programs through the 14th grade in other programs.

Results of the General Knowledge Assessments

When we look at the results, we see that the U.S. was among the lowest performing countries on both the mathematics and science general knowledge assessments. U.S. performance was below the international average in both mathematics and science. In mathematics we were outperformed by 14 out of 20 countries, were

Results of the Advanced Students Assessments

U.S. student performance on the assessments in Advanced Mathematics and Physics was among the lowest of participating countries and, in both cases, below the international average. On the Advanced Mathematics assessment, the U.S. was outperformed by 11 countries, was similar to four countries, and did not outperform any country. On the Physics assessment, the U.S. was outperformed by 14 countries, was the same as one country, and did not outperform any country. On all five content areas that make up Physics and all three content areas comprising Advanced Mathematics, the U.S. was below the international average and was outperformed by a majority of the other countries.

Who took the advanced TIMSS assessments? A random sample of the approximately 10-20 percent of students in the last year of school in each country took these tests. In the U.S. the students who took the Advanced Mathematics TIMSS had already taken or were currently enrolled in precalculus, calculus, or Advanced Placement Calculus. They represented 14 percent of young people their age in the U.S. compared with the 19 percent average for the 16 countries as a whole. In the U.S. the students who took the Physics assessment had previously taken or were currently enrolled in Physics. They represented 14 percent of young people their age which was the same as the international average for all participating countries. Therefore, the U.S. performance was not the result of any differences in the selectivity of students taking the assessments.

When we compare these international students to our most advanced students, we come closer to the international average. In the U.S., many of our advanced students do not take calculus, but a quarter of the items on TIMSS Advanced Mathematics assessment are Calculus questions. When we looked at U.S. students who had taken calculus, we found that their performance were close to the international advanced student average. Six countries outperformed this U.S. Calculus population, seven were similar, and the U.S. outperformed two countries. If we compare only those U.S. students with Advanced Placement Calculus to the international advanced mathematics group, only France outscored the U.S. Advanced Placement students. The U.S. outperformed five countries and seven were similar to the U.S. In Physics, when the U.S. Advanced Placement Physics students were compared with the Physics students in other countries, the U.S. students were outperformed by four countries, were similar to ten countries, and outperformed one country.

Factors Related to Performance

Our analysis of TIMSS data do not suggest any single cause of this level of U.S. performance. For example:

- Television: Students in other countries watch just as much television as our students;
- Part-time jobs: More U.S. students work in part-time jobs and work more hours than students in countries that scored