Highlights from the Third International Mathematics and Science Study–Repeat (TIMSS–R)

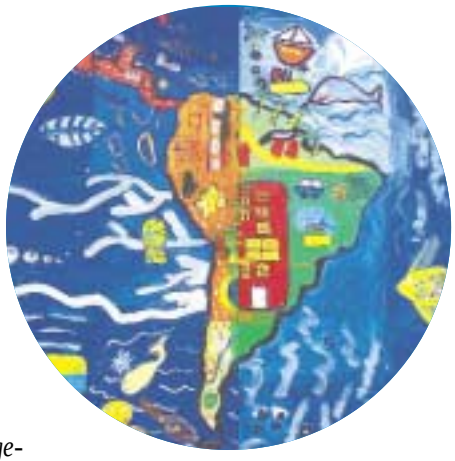
The 1999 Third International Mathematics and Science Study–Repeat (TIMSS–R) is a successor to the 1995 TIMSS and focuses on the mathematics and science achievement of eighth-grade students in participating nations. It provides a second data point in a regular cycle of international assessments of mathematics and science that are planned to chart trends in achievement over time, much like the regular cycle of national assessments in this nation, such as the National Assessment of Educational Progress (NAEP).

The 1995 TIMSS assessed the mathematics and science performance of U.S. students in comparison to their peers in other nations at three different grade levels. The 1995 TIMSS assessments revealed that U.S. fourth-graders performed well in both mathematics and science in comparison to students in other nations, U.S. eighth-grade students performed near the international average in both mathematics and science, and U.S. twelfth-graders scored below the international average and among the lowest of the TIMSS nations in mathematics and science general knowledge, as well as in physics and advanced mathematics.

Thirty-eight nations chose to compare the mathematics and science performance of their students in 1999. TIMSS–R allows the United States to compare the achievement of its eighth-graders in the original TIMSS to the achievement of its eighth-graders 4 years later. It also provides an opportunity to compare the relative performance of U.S. fourth-graders in 1995 to the relative performance of U.S. eighth-graders 4 years later in 1999. TIMSS–R includes a videotape study of eighth-grade mathematics and science teaching in seven nations, a voluntary benchmarking study for 27 U.S. states and districts, and a linking study between NAEP and TIMSS–R. Through these components, TIMSS–R has collected information on schools, curricula, instruction, lessons, and the lives of teachers and students to understand the educational context in which mathematics and science learning takes place.

Performance in the United States is presented relative to that of other nations that participated in each assessment. Comparisons are made between the 38 nations that participated in TIMSS–R in 1999; between the 23 nations that participated in both TIMSS and TIMSS–R at the eighth-grade level; and between the 17 nations that participated at the fourth-grade level in TIMSS and at the eighth-grade level in TIMSS–R. This brochure is based on the comparative data published in the report *Pursuing Excellence: Comparisons of International Eighth-Grade Mathematics and Science Achievement from a U.S. Perspective, 1995 and 1999* (NCES 2000).

The Mathematics and Science Achievement of Eighth-Graders in 1999



- In 1999, U.S. eighth-graders exceeded the international average of 38 nations in mathematics and science.
- In mathematics, U.S. eighth-grade students outperformed their peers in 17 nations, performed similarly to their peers in 6 nations, and performed lower than their peers in 14 nations in 1999 (Figure 1).
- In science, U.S. eighth-grade students outperformed their peers in 18 nations, performed similarly to their peers in 5 nations, and performed lower than their peers in 14 nations in 1999 (Figure 1).
- Of the five mathematics content areas assessed in 1999, U.S. eighth-graders performed higher than the international average in *fractions and number sense*; *data representation, analysis, and probability*; and *algebra*. They performed at the international average of the 38 TIMSS–R nations in *measurement* and *geometry*.
- Of the six science content areas assessed in 1999, U.S. eighth-graders performed higher than the international average in *earth science*; *chemistry*; *life science*; *environmental and resource issues*; and *scientific inquiry and the nature of science*. They performed at the international average of the 38 TIMSS–R nations in *physics*.

- In 1999, the United States was one of 34 TIMSS–R nations in which eighth-grade boys and girls performed similarly in mathematics. In four nations, eighth-grade boys outperformed eighth-grade girls in mathematics.
- In 1999, the United States was one of 16 TIMSS–R nations in which eighth-grade boys outperformed eighth-grade girls in science. In 22 nations, no difference between the achievement of eighth-grade boys and girls was found.

Figure 1.—Average mathematics and science achievement of eighth-grade students, by nation: 1999

MATHEMATICS	
Nation	Average
Singapore	604
Korea, Republic of	587
Chinese Taipei	585
Hong Kong SAR	582
Japan	579
Belgium-Flemish	558
Netherlands	540
Slovak Republic	534
Hungary	532
Canada	531
Slovenia	530
Russian Federation	526
Australia	525
Finland[1]	520
Czech Republic	520
Malaysia	519
Bulgaria	511
Latvia-LSS[2]	505
United States	502
England	496
New Zealand	491
Lithuania[3]	482
Italy	479
Cyprus	476
Romania	472
Moldova	469
Thailand	467
(Israel)	466
Tunisia	448
Macedonia, Republic of	447
Turkey	429
Jordan	428
Iran, Islamic Republic of	422
Indonesia	403
Chile	392
Philippines	345
Morocco	337
South Africa	275
International average of 38 nations	487

SCIENCE	
Nation	Average
Chinese Taipei	569
Singapore	568
Hungary	552
Japan	550
Korea, Republic of	549
Netherlands	545
Australia	540
Czech Republic	539
England	538
Finland	535
Slovak Republic	535
Belgium-Flemish	535
Slovenia	533
Canada	533
Hong Kong SAR	530
Russian Federation	529
Bulgaria	518
United States	515
New Zealand	510
Latvia-LSS[2]	503
Italy	493
Malaysia	492
Lithuania[3]	488
Thailand	482
Romania	472
(Israel)	468
Cyprus	460
Moldova	459
Macedonia, Republic of	458
Jordan	450
Iran, Islamic Republic of	448
Indonesia	435
Turkey	433
Tunisia	430
Chile	420
Philippines	345
Morocco	323
South Africa	243
International average of 38 nations	488

Average is significantly higher than the U.S. average
Average does not differ significantly from the U.S. average
Average is significantly lower than the U.S. average

[1]The shading of Finland may appear incorrect; however, statistically, its placement is correct.

[2]Designated LSS because only Latvian-speaking schools were tested which represents 61 percent of the population.

[3]Lithuania tested the same cohort of students as other nations, but later in 1999, at the beginning of the next school year.

NOTE: Eighth grade in most nations. See NCES (2000) for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines. See NCES (2000) for details.
The international average is the average of the national averages of the 38 nations.

SOURCE: National Center for Education Statistics, U.S. Department of Education. (2000). *Pursuing Excellence: Comparisons of International Eighth-Grade Mathematics and Science Achievement from a U.S. Perspective, 1995 and 1999.* NCES 2001–028. Figure 2. Washington, DC: U.S. Government Printing Office.

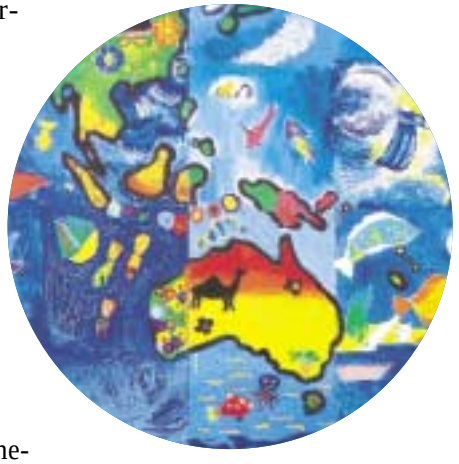
The Mathematics and Science Achievement of Eighth-Graders Between 1995 and 1999

Comparisons of mathematics and science achievement between 1995 and 1999 are made between the 23 nations that participated at the eighth-grade level in both TIMSS and TIMSS–R.

- Between 1995 and 1999, there was no change in eighth-grade mathematics or science achievement in the United States (Figures 2 and 3). Among the 22 other nations, there was no change in mathematics achievement for 18 nations, and no change in science achievement for 17 nations.
- Across the five mathematics content areas in common[1] between TIMSS and TIMSS–R, there was no change in achievement for eighth-graders in the United States and most of the other 22 nations.
- Across the four science content areas in common[2] between TIMSS and TIMSS–R, there was no change in achievement for eighth-graders in the United States and most of the other 22 nations.
- U.S. eighth-grade black students showed an increase in their achievement in mathematics over the 4 years. They showed no change in their achievement in science over the same period. U.S. eighth-grade white and Hispanic students showed no change in their mathematics or science achievement between 1995 and 1999.
- There were no changes in mathematics and science achievement for U.S. eighth-grade boys and girls between 1995 and 1999.

The Mathematics and Science Achievement of the 1995 Fourth-Grade Cohort in 1999

Because both TIMSS and TIMSS–R used nationally representative samples of students in a particular grade, the 1995 TIMSS fourth-graders and the 1999 TIMSS–R eighth-graders represent the same group (or "cohort") of students at two different points in time. These students' performance in 1995 can be compared to their performance in 1999. However, direct comparisons between the 1995 fourth-grade TIMSS assessment and the 1999 eighth-grade TIMSS–R assessment are complicated by several factors, including differences in the content areas assessed and the questions that can be asked between the two grade levels. Therefore, comparisons between TIMSS fourth graders and TIMSS–R eighth graders are based on their performance relative to the international average of the 17 nations that participated in fourth-grade TIMSS and eighth-grade TIMSS–R.



- The mathematics and science performance of the United States relative to this group of nations was lower for eighth-graders in 1999 than it was for fourth-graders 4 years earlier, in 1995.
- Among the 16 other nations, the mathematics performance of Canada relative to this group of nations was higher for eighth-graders in 1999 than it was for fourth-graders 4 years earlier, in 1995; the mathematics performance of the Czech Republic, Italy, and the Netherlands relative to this group of nations was lower; and the mathematics performance of the 12 other nations was unchanged.

[1] TIMSS and TIMSS–R had the following mathematics content areas in common: *fractions and number sense*; *measurement*; *data representation, analysis, and probability*; *geometry*; and *algebra*.

[2] TIMSS and TIMSS–R had the following science content areas in common: *earth science*; *life science*; *physics*; and *chemistry*.

Figure 2.—Comparisons of eighth-grade mathematics achievement, by nation: 1995 and 1999

Nation	1995 average	1999 average	1995–1999 difference[3]
(Latvia-LSS)[1]	488	505	17 ▲
Canada	521	531	10 ▲
Cyprus	468	476	9 ▲
Hong Kong SAR	569	582	13 ●
(Netherlands)	529	540	11 ●
(Lithuania)[2]	472	482	10 ●
United States	492	502	9 ●
Belgium-Flemish	550	558	8 ●
Korea, Republic of	581	587	6 ●
(Australia)	519	525	6 ●
Hungary	527	532	5 ●
Iran, Islamic Republic of	418	422	4 ●
Russian Federation	524	526	2 ●
Slovak Republic	534	534	0 ●
(Slovenia)	531	530	-1 ●
(Romania)	474	472	-1 ●
(England)	498	496	-1 ●
Japan	581	579	-2 ●
Singapore	609	604	-4 ●
Italy	491	485	-6 ●
New Zealand	501	491	-10 ●
(Bulgaria)	527	511	-16 ●
Czech Republic	546	520	-26 ▼
International average of 23 nations	519	521	2 ●

Figure 3.—Comparisons of eighth-grade science achievement, by nation: 1995 and 1999

Nation	1995 average	1999 average	1995–1999 difference[3]
(Latvia-LSS)[1]	476	503	27 ▲
(Lithuania)[2]	464	488	25 ▲
Canada	514	533	19 ▲
Hungary	537	552	16 ▲
Hong Kong SAR	510	530	20 ●
(Australia)	527	540	14 ●
Cyprus	452	460	8 ●
Russian Federation	523	529	7 ●
(England)	533	538	5 ●
(Netherlands)	541	545	3 ●
Slovak Republic	532	535	3 ●
Korea, Republic of	546	549	3 ●
United States	513	515	2 ●
Belgium-Flemish	533	535	2 ●
(Romania)	471	472	1 ●
Italy	497	498	1 ●
New Zealand	511	510	-1 ●
Japan	554	550	-5 ●
(Slovenia)	541	533	-8 ●
Singapore	580	568	-12 ●
Iran, Islamic Republic of	463	448	-15 ●
Czech Republic	555	539	-16 ●
(Bulgaria)	545	518	-27 ▼
International average of 23 nations	518	521	3 ●

▲ The 1999 average is significantly higher than the 1995 average
● The 1999 average does not differ significantly from the 1995 average
▼ The 1999 average is significantly lower than the 1995 average

[1]Designated LSS because only Latvian-speaking schools were tested.

[2]Lithuania tested the same cohort of students as other nations, but later in 1999, at the beginning of the next school year.

[3]Difference is calculated by subtracting the 1995 score from the 1999 score. Detail may not sum to totals due to rounding.

NOTE: Eighth grade in most nations. See NCES (2000) for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines in 1995, 1999, or both years. See NCES (2000) for details.
The international average is the average of the national averages of the 23 nations with approved sampling procedures.
The tests for significance take into account the standard error for the reported differences. Thus, a small difference between the 1995 and 1999 averages for one nation may be significant while a large difference for another nation may not be significant.
The 1995 scores are based on re-scaled data.

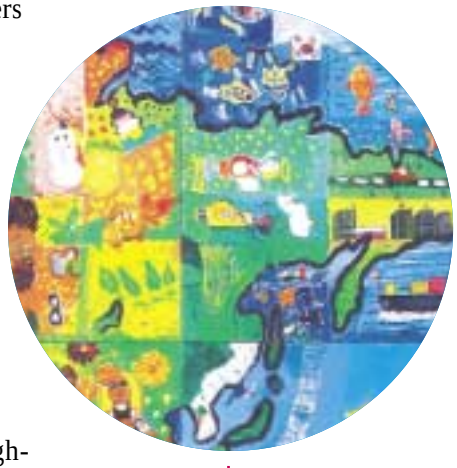
SOURCE: National Center for Education Statistics, U.S. Department of Education. (2000). *Pursuing Excellence: Comparisons of International Mathematics and Science Achievement from a U.S. Perspective, 1995 and 1999*. NCES 2001–028. Figures 18 and 19. Washington, DC: U.S. Government Printing Office.

- Among the 16 other nations, the science performance of Hungary and Singapore relative to this group of nations was higher for eighth-graders in 1999 than it was for fourth-graders 4 years earlier in 1995; the science performance of Italy and New Zealand relative to this group of nations was lower; and the science performance of the 12 other nations was unchanged.

Teaching and Curriculum in 1999

It is too early in the process of data analysis to provide strong evidence to suggest factors that may be related to patterns of achievement on TIMSS–R. However, differences in teaching and curriculum between the United States and other TIMSS–R nations were noted.

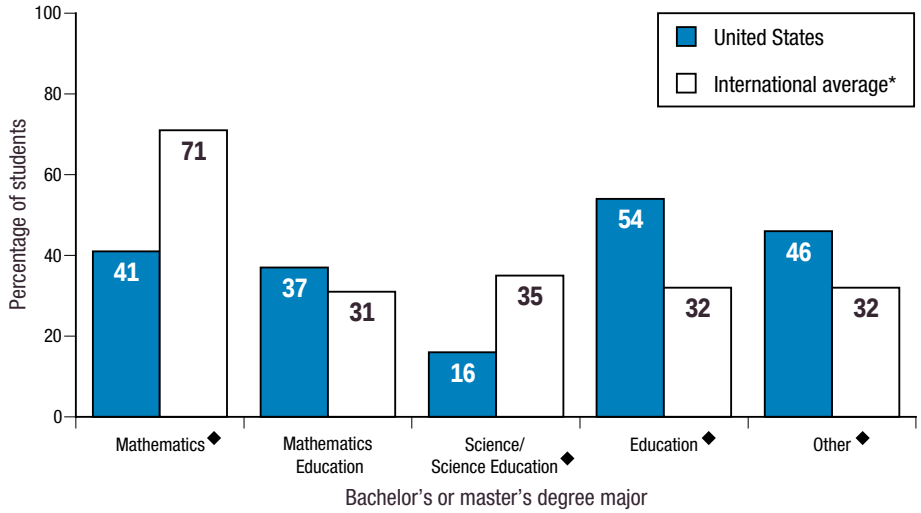
- According to their teachers, U.S. eighth-grade students were less likely than their international peers to be taught mathematics by teachers with a major or main area of study in mathematics, but as likely as their international peers to be taught by teachers who majored in mathematics education (Figure 4).
- According to their teachers, U.S. eighth-grade students were less likely than their international peers to be taught science by teachers with a degree in physics, but as likely as their international peers to be taught science by teachers with a major or main area of study in biology, chemistry, or science education in 1999 (Figure 5).



- Ninety-four percent of U.S. eighth-graders said that their mathematics teachers showed them how to do mathematics problems almost always or pretty often in 1999, which was higher than the international average of 86 percent.
- Eighty-six percent of U.S. eighth-grade students reported that they worked from worksheets or textbooks on their own almost always or pretty often during mathematics lessons in 1999, which was higher than the international average of 59 percent.
- Eighty percent of U.S. eighth-grade students were asked to explain the reasoning behind an idea in most or every science lesson in 1999, a higher percentage than the international average of 67 percent.
- When students were asked how often they conducted an experiment or practical investigation in their science lessons, 65 percent of U.S. eighth-graders reported that this occurred almost always or pretty often during their science lessons in 1999. This was higher than the international average of 57 percent.

- A higher percentage of U.S. eighth-graders reported using computers almost always or pretty often in mathematics classes (12 percent) and science classes (21 percent) than their international peers in 1999 (5 and 8 percent, respectively).
- According to their schools, U.S. eighth-grade students in 1999 were more than twice as likely as their international peers to attend schools with networked computer access to the Internet (91 percent compared to 41 percent).
- A higher percentage of U.S. eighth-grade students reported that they could almost always or pretty often begin their mathematics or science homework during class (74 percent and 57 percent, respectively) than their international peers (42 percent and 41 percent, respectively).

Figure 4.—Eighth-grade mathematics teachers' reports on their main area of study: 1999



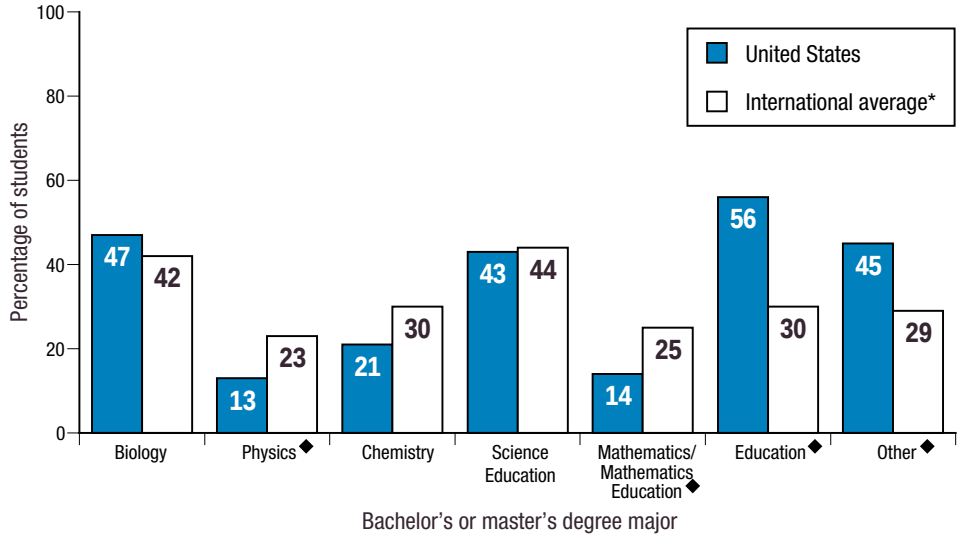
* The item response rate for this question was less than 70 percent in some nations.

◆ Significant difference between U.S. average and international average in this category.

NOTE: Science includes biology, physics, chemistry, and science education.
Mathematics teachers' reports of main area or areas of study for bachelor's and/or master's degree. More than one category could be selected.
Eighth grade in most nations. See NCES(2000) for details.
The international average is the average of the national averages of the nations that reported data.

SOURCE: National Center for Education Statistics, United States Department of Education. (2000). *Pursuing Excellence: Comparisons of International Eighth-Grade Mathematics and Science Achievement from a U.S. Perspective, 1995 and 1999*. NCES 2001–028. Figure 25. Washington, DC: U.S. Government Printing Office.

Figure 5.—Eighth-grade science teachers' reports on their main area of study: 1999



* The item response rate for this question was less than 70 percent in some nations.

◆ Significant difference between U.S. average and international average in this category.

NOTE: Science teachers' reports of main area or areas of study for bachelor's and/or master's degree. More than one category could be selected.
Eighth grade in most nations. See NCES(2000) for details.
The international average is the average of the national averages of the 23 nations that reported teaching a general/integrated science curriculum.

SOURCE: National Center for Education Statistics, United States Department of Education. (2000). *Pursuing Excellence: Comparisons of International Eighth-Grade Mathematics and Science Achievement from a U.S. Perspective, 1995 and 1999*. NCES 2001–028. Figure 26. Washington, DC: U.S. Government Printing Office.

SOURCE: National Center for Education Statistics, U.S. Department of Education. (2000). *Pursuing Excellence: Comparisons of International Eighth-Grade Mathematics and Science Achievement from a U.S. Perspective, 1995 and 1999*. P. Gonzales, C. Calsyn, L. Jocelyn, K. Mak, D. Kastberg, S. Arafeh, T. Williams, and W. Tsen. NCES 2001–028. Washington, DC: U.S. Government Printing Office.

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