North Carolina Highlights from Trends in Mathematics and Science Studies (TIMSS) 2011

Mathematics and Science Achievement
for U.S. Fourth and Eighth-Grade
Students in an International Context

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Executive Summary

The Trends in International Mathematics and Science Study (TIMSS) is an international comparative study of student achievement. TIMSS 2011 represents the fifth such study since TIMSS was first conducted in 1995. Developed and implemented at the international level by the International Association for the Evaluation of Educational Achievement (IEA)—an international organization of national research institutions and governmental research agencies—TIMSS assesses the mathematics and science knowledge and skills of 4th- and 8th-graders. TIMSS is designed to align broadly with mathematics and science curricula in the participating countries and education systems.

This report focuses on the performance of U.S. students[1] relative to their peers around the world in countries and other education systems that participated in TIMSS 2011. For the purposes of this report, "countries" are complete, independent political entities, whereas "other education systems" represent a portion of a country, nation, kingdom, or emirate or are other non-national entities (e.g., U.S. states, Canadian provinces, Flemish Belgium, and Northern Ireland). In this report, these "other education systems" are designated as such by their national three-letter international abbreviation appended to their name (e.g., England-GBR, Ontario-CAN). This report also examines changes in mathematics and science achievement compared with TIMSS 1995 and TIMSS 2007.

In 2011, TIMSS was administered at grade 4 in 57 countries and other education systems and, at grade 8, in 56 countries and other education systems.[2] These total counts include U.S. states that participated in TIMSS 2011 not only as part of the U.S. national sample of public and private schools but also individually with state-level public school samples. At grade 4, this was Florida and North Carolina, and at grade 8 this was Alabama, California, Colorado, Connecticut, Florida, Indiana, Massachusetts, Minnesota, and North Carolina. Note that, because all TIMSS participants are treated equally, these states are compared with the United States (national sample) throughout this report. All differences described in this report are statistically significant at the .05 level. No statistical adjustments to account for multiple comparisons were used.

Key findings from the report include the following:

Mathematics at grade 4

- The U.S. average mathematics score at grade 4 (541) was higher than the international TIMSS scale average, which is set at 500.[3]
- At grade 4, the United States was among the top 15 education systems in mathematics (8 education systems had higher averages and 6 were not measurably different) and scored higher, on average, than 42 education systems.
  - The 8 education systems with average mathematics scores above the U.S. score were Singapore, Korea, Hong Kong-CHN, Chinese Taipei-CHN, Japan, Northern Ireland-GBR, North Carolina-USA, and Belgium (Flemish)-BEL.
  - Among the U.S. states that participated in TIMSS at grade 4, North Carolina scored above the TIMSS scale average and the U.S. national average in mathematics, while Florida scored above the TIMSS scale average but was not measurably different from the U.S. national average.
- Compared with 1995, the U.S. average mathematics score at grade 4 was 23 score points higher in 2011 (541 vs. 518).
- Compared with 2007, the U.S. average mathematics score at grade 4 was 12 score points higher in 2011 (541 vs. 529).
- The percentage of 4th-graders performing at or above the *Advanced* international mathematics benchmark in 2011 was higher than in the United States in 7 education systems, was not different in 4 education systems, and was lower than in the United States in 45 education systems.[4]

[1] At grade 4, a total of 369 schools and 12,569 students participated in the United States in 2011. At grade 8, a total of 501 schools and 10,477 students participated. The overall weighted school response rate in the United States was 79 percent at grade 4 before the use of substitute schools. The weighted student response rate at grade 4 was 95 percent. At grade 8, the overall weighted school response rate before the use of substitute schools was 87 percent. The weighted student response rate at grade 8 was 94 percent.

[2] The 57 education systems that administered TIMSS at grade 4 overlap only partially with the set of 56 education systems that administered it at grade 8 (see table 1 for details). The total number of education systems reported here differs from the total number reported in the international TIMSS reports (Mullis et al. 2012; Martin et al. 2012) because some education systems administered the TIMSS grade 4 assessment to 6th-grade students, and some administered the TIMSS grade 8 assessment to 9th-grade students. Education systems that did not assess students at the target grade level are not counted or included in this report.

[3] TIMSS provides two overall scales—mathematics and science—as well as several content and cognitive domain subscales for each of the overall scales. The scores are reported on a scale from 0 to 1,000, with the TIMSS scale average set at 500 and standard deviation set at 100.

[4] TIMSS reports on four benchmarks to describe student performance in mathematics and science. Each benchmark is associated with a score on the achievement scale and a description of the knowledge and skills demonstrated by students at that level of achievement. The Advanced international benchmark indicates that students scored 625 or higher. More information on the benchmarks can be found in the main body of the report and appendix A.

Mathematics at grade 8

- The U.S. average mathematics score at grade 8 (509) was higher than the international TIMSS scale average, which is set at 500.
- At grade 8, the United States was among the top 24 education systems in mathematics (11 education systems had higher averages and 12 were not measurably different) and scored higher, on average, than 32 education systems.
  - The 11 education systems with average mathematics scores above the U.S. score were Korea, Singapore, Chinese Taipei-CHN, Hong Kong-CHN, Japan, Massachusetts-USA, Minnesota-USA, the Russian Federation, North Carolina-USA, Quebec-CAN, and Indiana-USA.
  - Among the U.S. states that participated in TIMSS at grade 8, Massachusetts, Minnesota, North Carolina, and Indiana scored both above the TIMSS scale average and the U.S. national average in mathematics. Colorado, Connecticut, and Florida scored above the TIMSS scale average, but they were not measurably different from the U.S. national average. California was not measurably different from the TIMSS scale average but scored below the U.S. national average, while Alabama scored both below the TIMSS scale average and the U.S. national average in mathematics.
- Compared with 1995, the U.S. average mathematics score at grade 8 was 17 score points higher in 2011 (509 vs. 492).
- There was no measurable difference between the U.S. average score in 2007 (508) and in 2011 (509).
- The percentage of 8th-grade students performing at or above the *Advanced* international mathematics benchmark in 2011 was higher than in the United States in 11 education systems; was not different in 13 education systems; and was lower than in the United States in 31 education systems.

Science at grade 4

- In 2011, the average science score of U.S. 4th-graders (544) was higher than the international TIMSS scale average, which is set at 500.
- At grade 4, the United States was among the top 10 education systems in science (6 education systems had higher averages and 3 were not measurably different) and scored higher, on average, than 47 education systems.
  - The 6 education systems with average science scores above the U.S. score were Korea, Singapore, Finland, Japan, the Russian Federation, and Chinese Taipei-CHN.
  - Among the U.S. states that participated in TIMSS at grade 4, both Florida and North Carolina scored above the TIMSS scale average but were not measurably different from the U.S. national average.
- There was no measurable difference between the U.S. average science score at grade 4 in 1995 (542) and in 2011 (544).
- There was no measurable difference between the U.S. average score in 2007 (539) and in 2011 (544).
- The percentage of 4th-graders performing at or above the *Advanced* international science benchmark in 2011 was higher than in the United States in 3 education systems, was not different in 6 education systems, and was lower than in the United States in 47 education systems.

Science at grade 8

- In 2011, the average science score of U.S. 8th-graders (525) was higher than the TIMSS scale average, which is set at 500.
- At grade 8, the United States was among the top 23 education systems in science (12 education systems had higher averages and 10 were not measurably different) and scored higher, on average, than 33 education systems.
  - The 12 education systems with average science scores above the U.S. score were Singapore, Massachusetts-USA, Chinese Taipei-CHN, Korea, Japan, Minnesota-USA, Finland, Alberta-CAN, Slovenia, the Russian Federation, Colorado-USA, and Hong Kong-CHN.
  - Among the U.S. states that participated in TIMSS at grade 8, Massachusetts, Minnesota, and Colorado scored both above the TIMSS scale average and the U.S. national average in science. Indiana, Connecticut, North Carolina, and Florida scored above the TIMSS scale average, but they were not measurably different from the U.S. national average. California was not measurably different from the TIMSS scale average but scored below the U.S. national average, while Alabama scored both below the TIMSS scale average and the U.S. national average in science.
- Compared with 1995, the U.S. average science score was 12 score points higher in 2011 (525 vs. 513).
- There was no measurable difference between the U.S. average score in 2007 (520) and in 2011 (525).
- The percentage of 8th-grade students performing at or above the *Advanced* international science benchmark in 2011 was higher than in the United States in 12 education systems, was not different in 10 education systems, and was lower than in the United States in 33 education systems.

Introduction

TIMSS in brief

The Trends in International Mathematics and Science Study (TIMSS) is an international comparative study of student achievement. TIMSS 2011 represents the fifth such study since TIMSS was first conducted in 1995. Developed and implemented at the international level by the International Association for the Evaluation of Educational Achievement (IEA), an international organization of national research institutions and governmental research agencies, TIMSS is used to measure the mathematics and science knowledge and skills of 4th- and 8th-graders over time.

TIMSS is designed to align broadly with mathematics and science curricula in the participating countries and education systems. The results, therefore, suggest the degree to which students have learned mathematics and science concepts and skills likely to have been taught in school. TIMSS also collects background information on students, teachers, schools, curricula, and official education policies to allow cross-national comparison of educational contexts that may be related to student achievement. In 2011, there were 54 countries and 20 other education systems that participated in TIMSS, at the 4th- or 8th-grade level, or both.[1] For the purposes of this report, "countries" are complete, independent political entities, whereas "other education systems" represent a portion of a country, nation, kingdom, or emirate or are other non-national entities. Thus the category "other education systems" includes all U.S. states and Canadian provinces that participated as "benchmarking participants"[2] as well as Flemish Belgium, Chinese Taipei, England, Hong Kong Special Administrative Region, Northern Ireland, and the Palestinian National Authority. In this report these "other education systems" are designated as such by their national three-letter international abbreviation appended to their name (e.g., England-GBR, Ontario-CAN).

This report presents the performance of U.S. students relative to their peers in other countries and other education systems, and reports on changes in mathematics and science achievement since 1995. Most of the findings in the report are based on the results presented in two international reports published by the IEA and available online at http://www.timss.org:

- *TIMSS 2011 International Results in Mathematics* (Mullis et al. 2012); and
- *TIMSS 2011 International Results in Science* (Martin et al. 2012).

[1]This count of countries and other education systems differs from the totals in table 1 because countries that gave the 4th-grade assessment to 6th-graders and the 8th-grade assessment to 9th-graders are excluded from the analyses in this report.

[2]Subnational entities that are not members of the IEA can participate in TIMSS as *benchmarking participants*, which affords them the opportunity to assess the comparative international standing of their students' achievement and to view their curriculum and instruction in an international context.

Countries or Education Systems?

The international bodies that coordinate international assessments vary in the labels they apply to participating entities. For example, the IEA, which coordinates TIMSS and the Progress in International Reading Literacy Study (PIRLS), differentiates between IEA members, which the IEA refers to as "countries" in all cases, and "benchmarking participants." IEA members include countries such as the United States and Japan, as well as subnational entities, such as England and Scotland (which are both part of the United Kingdom), the Flemish community of Belgium and the French community of Belgium, and Hong Kong, which is a Special Administrative Region of China. IEA benchmarking participants are all subnational entities and include U.S. states, Dubai in the United Arab Emirates, and, in 2011, participating Canadian provinces. The Organization for Economic Cooperation and Development (OECD), which coordinates the Program for International Student Assessment (PISA), differentiates between OECD member countries and all other participating entities (called "partner countries" or "partner economies"), which include countries and subnational entities. In PISA, the United Kingdom and Belgium are reported as whole countries. Hong Kong is a PISA partner country, as are countries like Singapore, which is not an OECD member but is an IEA member.

In an effort to increase the comparability of results across the international assessments in which the United States participates, this report uses a standard international classification of nation-states (see the U.S. State Department list of "independent states" at http://www.state.gov/s/inr/rls/4250.htm) to report out separately "countries" and "other education systems," which include all other non-national entities that received a TIMSS score. This report's tables and figures, which are primarily adapted from the IEA's TIMSS 2011 report, follow the IEA TIMSS convention of placing members and nonmembers in separate parts of the tables and figures in order to facilitate readers moving between the international and U.S. national report. However, the text of this report refers to "countries" and "other education systems," following the standard classification of nation-states.

TIMSS 2011 results for North Carolina

Mathematics - Grade 4 and 8

- Public school students' average score was 554 at grade 4 and 537 at grade 8.
- Higher percentages of North Carolina 4th- and 8th-graders performed at or above each of the four TIMSS international benchmarks than the international medians. For example, 16 percent of 4th-graders and 14 percent of 8th-graders in North Carolina performed at or above the *Advanced* benchmark (625) compared to the international median of 4 percent at grade 4 and 3 percent at grade 8 (figures 3 and 4).
- Males outperformed females by 12 score points, on average, at grade 4. At both grade 4 and 8, males and females scored higher in mathematics, on average, than the TIMSS scale average (table 25).

Average mathematics scores of 4th- and 8th-grade students in North Carolina public schools compared with other participating education systems: 2011

Grade 4		Grade 8	
Education systems higher than North Carolina		**Education systems higher than North Carolina**	
Singapore		Korea, Rep. of	*Massachusetts-USA*
Korea, Rep. of		Singapore	
Hong Kong-CHN		*Chinese Taipei-CHN*	
Chinese Taipei-CHN		*Hong Kong-CHN*	
Japan		Japan	
Education systems not measurably different from North Carolina		**Education systems not measurably different from North Carolina**	
Northern Ireland-GBR	*Florida-USA*	*Minnesota-USA*	*Indiana-USA*
Belgium (Flemish)-BEL		Russian Federation	
Finland		*Quebec-CAN*	
Education systems lower than North Carolina		**Education systems lower than North Carolina**	
England-GBR	Croatia	*Colorado-USA*	Romania
Russian Federation	New Zealand	*Connecticut-USA*	United Arab Emirates
United States	Spain	Israel	Turkey
Netherlands	Romania	Finland	Lebanon
Denmark	Poland	*Florida-USA*	*Abu Dhabi-UAE*
Lithuania	Turkey	*Ontario-CAN*	Malaysia
Quebec-CAN	*Dubai, UAE*	United States	Georgia
Portugal	Azerbaijan	*England-GBR*	Thailand
Germany	Chile	*Alberta-CAN*	Macedonia, Rep. of
Ireland	Thailand	Hungary	Tunisia
Ontario-CAN	Armenia	Australia	Chile
Serbia	Georgia	Slovenia	Iran, Islamic Rep. of
Australia	Bahrain	Lithuania	Qatar
Hungary	United Arab Emirates	Italy	Bahrain
Slovenia	Iran, Islamic Rep. of	*California-USA*	Jordan
Czech Republic	*Abu Dhabi, UAE*	New Zealand	*Palestinian Nat'l Auth.*
Austria	Qatar	Kazakhstan	Saudi Arabia
Italy	Saudi Arabia	Sweden	Indonesia
Slovak Republic	Oman	Ukraine	Syrian Arab Republic
Alberta-CAN	Tunisia	*Dubai-UAE*	Morocco
Sweden	Kuwait	Norway	Oman
Kazakhstan	Morocco	Armenia	Ghana
Malta	Yemen	*Alabama-USA*	
Norway			

NOTE: Italics indicate participants identified and counted in this report as an education system and not as a separate country.
SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

- At grade 4, all racial/ethnic groups performed above the TIMSS scale average. At grade 8, White, Asian, and multiracial students' average scores were above the TIMSS scale average, while Black and Hispanic students' average scores were not measurably different from the TIMSS scale average (table 25).
- In general, students at grade 4 scored higher, on average, than the TIMSS scale average. At grade 8 students in public schools with less than 50 percent of students eligible for free or reduced-price lunch scored higher, on average, than the TIMSS scale average, while average scores for students in public schools with 50 percent or more students eligible for free or reduced-price lunch were not measurably different from the TIMSS scale average.

Average mathematics scores in grade 4 and 8 for selected student groups in public schools in North Carolina: 2011

	Mathematics	
Reporting groups	Grade 4	Grade 8
TIMSS scale average	**500**	**500**
U.S. Average	**541 ***	**509 ***
North Carolina average	**554 ***	**537 ***
Sex		
Female	548 *	535 *
Male	560 *	539 *
Race/ethnicity		
White	577 *	563 *
Black	512 *	495
Hispanic	538 *	510
Asian	613 *	605 *
Multiracial	572 *	525 *
Percentage of pubic school students eligible for free or reduced-price lunch		
Less than 10 percent	‡	605 *
10 to 24.9 percent	587 *	572 *
25 to 49.9 percent	568 *	543 *
50 to 74.9 percent	550 *	521
75 percent or more	519 *	516

‡ Reporting standards not met.
*p<.05. Difference between score and TIMSS scale average is significant.
NOTE Black includes African American, Hispanic includes Latino, and Asian includes Pacific Islander and Native Hawaiian. Racial categories exclude Hispanic origin. Not all race/ethnicity categories are shown, but they are all included in the U.S. and state totals shown throughout the report. The standard errors of the estimates are shown in table E-21 available at http://nces.ed.gov/pubsearch/pubsinfor.asp?pubid=2013009.
SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Average mathematics scores of 4th-grade students, by education system: 2011

Grade 4		Grade 4	
Education system	**Average score**	**Education system**	**Average score**
TIMSS scale average	500	New Zealand	486 ▼
Singapore[1]	606 ▲	Spain	482 ▼
Korea, Rep. of	605 ▲	Romania	482 ▼
Hong Kong-CHN[1]	602 ▲	Poland	481 ▼
Chinese Taipei-CHN	591 ▲	Turkey	469 ▼
Japan	585 ▲	Azerbaijan[1,5]	463 ▼
Northern Ireland-GBR[2]	562 ▲	Chile	462 ▼
Belgium (Flemish)-BEL	549 ▲	Thailand	458 ▼
Finland	545	Armenia	452 ▼
England-GBR	542	Georgia[3,5]	450 ▼
Russian Federation	542	Bahrain	436 ▼
United States[1]	**541**	United Arab Emirates	434 ▼
Netherlands[2]	540	Iran, Islamic Rep. of	431 ▼
Denmark[1]	537	Qatar[1]	413 ▼
Lithuania[1,3]	534 ▼	Saudi Arabia	410 ▼
Portugal	532 ▼	Oman[6]	385 ▼
Germany	528 ▼	Tunisia[6]	359 ▼
Ireland	527 ▼	Kuwait[3,7]	342 ▼
Serbia[1]	516 ▼	Morocco[7]	335 ▼
Australia	516 ▼	Yemen[7]	248 ▼
Hungary	515 ▼		
Slovenia	513 ▼	**Benchmarking education systems**	
Czech Republic	511 ▼		
Austria	508 ▼	*North Carolina-USA*[1,3]	554 ▲
Italy	508 ▼	*Florida-USA*[3,8]	545
Slovak Republic	507 ▼	*Quebec-CAN*	533 ▼
Sweden	504 ▼	*Ontario-CAN*	518 ▼
Kazakhstan[1]	501 ▼	*Alberta-CAN*[1]	507 ▼
Malta	496 ▼	*Dubai-UAE*	468 ▼
Norway[4]	495 ▼	*Abu Dhabi-UAE*	417 ▼
Croatia[1]	490 ▼		

▲ Average score is higher than U.S. average score.
▼ Average score is lower than U.S. average score.
[1]National Defined Population covers 90 to 95 percent of National Target Population (see appendix A).
[2]Met guidelines for sample participation rates only after replacement schools were included.
[3]National Target Population does not include all of the International Target Population (see appendix A).
[4]Nearly satisfied guidelines for sample participation rates after replacement schools were included.
[5]Exclusion rates for Azerbaijan and Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.
[6]The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 15 percent, though it is less than 25 percent.
[7]The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 25 percent.
[8]National Defined Population covers less than 90 percent, but at least 77 percent, of National Target Population (see appendix A).
NOTE: Education systems are ordered by 2011 average score. Italics indicate participants identified and counted in this report as an education system and not as a separate country. Participants that did not administer TIMSS at the target grade are not shown; see the international report for their results. All U.S. state data are based on public school students only. All average scores reported as higher or lower than the U.S. average score are different at the .05 level of statistical significance. The tests for significance take into account the standard error for the reported difference. Thus, a small difference between the United States and one education system may be significant while a large difference between the United States and another education system may not be significant. The standard errors of the estimates are shown in table E-1 available at http://nces.ed.gov/pubsearch/pubsinfor.asp?pubid=2013009.
SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Average mathematics scores of 8th-grade students, by education system: 2011

Grade 8			Grade 8		
Education system	**Average score**		**Education system**	**Average score**	
TIMSS scale average	500		Chile	416	▼
Korea, Rep. of	613	▲	Iran, Islamic Rep. of[6]	415	▼
Singapore[1]	611	▲	Qatar[6]	410	▼
Chinese Taipei-CHN	609	▲	Bahrain[6]	409	▼
Hong Kong-CHN	586	▲	Jordan[6]	406	▼
Japan	570	▲	*Palestinian Nat'l Auth.*[6]	404	▼
Russian Federation[1]	539	▲	Saudi Arabia[6]	394	▼
Israel[2]	516		Indonesia[6]	386	▼
Finland	514		Syrian Arab Republic[6]	380	▼
United States[1]	**509**		Morocco[7]	371	▼
England-GBR[3]	507		Oman[6]	366	▼
Hungary	505		Ghana[7]	331	▼
Australia	505				
Slovenia	505		**Benchmarking education systems**		
Lithuania[4]	502				
Italy	498	▼	*Massachusetts-USA*[1,4]	561	▲
New Zealand	488	▼	*Minnesota-USA*[4]	545	▲
Kazakhstan	487	▼	*North Carolina-USA*[2,4]	537	▲
Sweden	484	▼	*Quebec-CAN*	532	▲
Ukraine	479	▼	*Indiana-USA*[1,4]	522	▲
Norway	475	▼	*Colorado-USA*[4]	518	
Armenia	467	▼	*Connecticut-USA*[1,4]	518	
Romania	458	▼	*Florida-USA*[1,4]	513	
United Arab Emirates	456	▼	*Ontario-CAN*[1]	512	
Turkey	452	▼	*Alberta-CAN*[1]	505	
Lebanon	449	▼	*California-USA*[1,4]	493	▼
Malaysia	440	▼	*Dubai-UAE*	478	▼
Georgia[4,5]	431	▼	*Alabama-USA*[4]	466	▼
Thailand	427	▼	*Abu Dhabi-UAE*	449	▼
Macedonia, Rep. of[6]	426	▼			
Tunisia	425	▼			

▲ Average score is higher than U.S. average score.
▼ Average score is lower than U.S. average score.
[1]National Defined Population covers 90 to 95 percent of National Target Population (see appendix A).
[2]National Defined Population covers less than 90 percent, but at least 77 percent, of National Target Population (see appendix A).
[3]Nearly satisfied guidelines for sample participation rates after replacement schools were included.
[4]National Target Population does not include all of the International Target Population (see appendix A).
[5]Exclusion rates for Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.
[6]The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 15 percent, though it is less than 25 percent.
[7]The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 25 percent.
NOTE: Education systems are ordered by 2011 average score. Italics indicate participants identified and counted in this report as an education system and not as a separate country. Participants that did not administer TIMSS at the target grade are not shown; see the international report for their results. All U.S. state data are based on public school students only. All average scores reported as higher or lower than the U.S. average score are different at the .05 level of statistical significance. The tests for significance take into account the standard error for the reported difference. Thus, a small difference between the United States and one education system may be significant while a large difference between the United States and another education system may not be significant. The standard errors of the estimates are shown in table E-2 available at http://nces.ed.gov/pubsearch/pubsinfor.asp?pubid=2013009.
SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Mathematics Performance in the United States and Internationally

Average scores in 2011

In mathematics, the U.S. national average score was 541 at grade 4 and 509 at grade 8 (tables 3 and 4). Both scores were higher than the TIMSS scale average, which is set at 500 for every administration of TIMSS at both grades.[11]

Among the 45 *countries* that participated at grade 4, the U.S. average mathematics score was among the top 8 (3 countries had higher averages and 4 had averages not measurably different from the United States). Thirty-seven countries had a lower average score than the United States.

Looking at all 57 *education systems* that participated at grade 4 (i.e., both countries and other education systems, including U.S. states that participated in TIMSS with individual state samples), the United States was among the top 15 education systems in average mathematics scores (8 education systems had higher averages and 6 were not measurably different). Singapore, Korea, Hong Kong-CHN, Chinese Taipei-CHN, Japan, Northern Ireland-GBR, North Carolina-USA, and Belgium (Flemish)-BEL had higher average scores than the United States; and Finland, Florida-USA, England-GBR, the Russian Federation, the Netherlands, and Denmark had average scores not measurably different from the U.S. average at grade 4. The United States outperformed 42 education systems.

At grade 8, among the 38 *countries* that participated in TIMSS, the U.S. average mathematics score was among the top 11 (4 countries had higher averages and 6 had averages not measurably different from the United States). Twenty-seven countries had lower average scores than the United States.

Looking at all 56 *education systems* that participated at grade 8, the United States was among the top 24 education systems in average mathematics scores (11 had higher averages and 12 were not measurably different). Korea, Singapore, Chinese Taipei-CHN, Hong Kong-CHN, Japan, Massachusetts-USA, Minnesota-USA, the Russian Federation, North Carolina-USA, Quebec-CAN, and Indiana-USA had higher average scores than the United States; and Colorado-USA, Connecticut-USA, Israel, Finland, Florida-USA, Ontario-CAN, England-GBR, Alberta-CAN, Hungary, Australia, Slovenia, and Lithuania had average scores not measurably different from the U.S. average at grade 8. The United States had a higher average mathematics score than 32 education systems.

[11] A score of 500 represents the international average of participants in the first administration of TIMSS in 1995. The TIMSS scale is the same in each administration such that a value of 500 in 2011 equals 500 in 1995.

TIMSS 2011 results for North Carolina

Science – Grades 4 and 8

- Public school students' average science score was 538 at grade 4 and 532 at grade 8.
- Higher percentages of North Carolina 4th- and 8th-graders performed at or above each of the four TIMSS international benchmarks than the international medians. For example, 12 percent of 4th-graders and 12 percent of 8th-graders in North Carolina performed at or above the *Advanced* benchmark (625) compared to the international median of 5 percent at grade 4 and 4 percent at grade 8 (figure 11 and 12).
- Males outperformed females by 9 score points on average in science at grade 4 and by 12 score points at grade 8 (figures 13 and 14). At both grade 4 and grade 8, male and female students in North Carolina scored higher, on average, in science than the TIMSS scale average (table 48).
- At grade 4, White, Hispanic, Asian, and multiracial students scored, on average, above the TIMSS scale average. Black students' average scores were not measurably different from the TIMSS scale average.

Continued on next page

Average science scores of 4th- and 8th-grade students in North Carolina public schools compared with other participating education systems: 2011

Grade 4	
Education systems higher than North Carolina	
Korea, Rep. of	Japan
Singapore	Russian Federation
Finland	*Chinese Taipei-CHN*
Education systems not measurably different from North Carolina	
Florida-USA	Slovak Republic
United States	Austria
Alberta-CAN	Netherlands
Czech Republic	*England-GBR*
Hong Kong-CHN	Denmark
Hungary	Germany
Sweden	*Ontario-CAN*
Education systems lower than North Carolina	
Italy	Thailand
Portugal	Turkey
Slovenia	*Dubai-UAE*
Northern Ireland-GBR	Georgia
Quebec-*CAN*	Iran, Islamic Rep. of
Ireland	Bahrain
Croatia	Malta
Australia	Azerbaijan
Serbia	Saudi Arabia
Lithuania	United Arab Emirates
Belgium (Flemish)-BEL	Armenia
Romania	*Abu Dhabi-UAE*
Spain	Qatar
Poland	Oman
New Zealand	Kuwait
Kazakhstan	Tunisia
Norway	Morocco
Chile	Yemen

Grade 8	
Education systems higher than North Carolina	
Singapore	Japan
Massachusetts-USA	*Minnesota-USA*
Chinese Taipei-CHN	Finland
Korea, Rep. of	*Alberta-CAN*
Education systems not measurably different from North Carolina	
Slovenia	*Florida-USA*
Russian Federation	United States
Colorado-USA	Hungary
Hong Kong-CHN	*Ontario-CAN*
England-GBR	*Quebec-CAN*
Indiana-USA	Australia
Connecticut-USA	
Education systems lower than North Carolina	
Israel	Bahrain
Lithuania	Thailand
New Zealand	Jordan
Sweden	Tunisia
Italy	Armenia
Ukraine	Saudi Arabia
California-USA	Malaysia
Norway	Syrian Arab Republic
Kazakhstan	*Palestinian Nat'l Auth.*
Alabama-USA	Georgia
Dubai-UAE	Oman
Turkey	Qatar
Iran, Islamic Rep. of	Macedonia, Rep. of
Romania	Lebanon
United Arab Emirates	Indonesia
Chile	Morocco
Abu Dhabi-UAE	Ghana

NOTE: Italics indicate participants identified and counted in this report as an education system and not as a separate country.
SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

- At grade 8, White and Asian students scored, on average, above the TIMSS scale average while Black students scored lower, on average. Hispanic and multiracial students' average scores were not measurably different from the TIMSS scale average.
- In general, at grade 4 students in public schools with less than 75 percent of students eligible for free or reduced-price lunch scored higher, on average, than the TIMSS scale average. Average scores among students in public schools with 75 percent or more of students eligible for free or reduced-price lunch were not measurably different from the TIMSS scale average. At grade 8, students in public schools with less than 50 percent of students eligible for free or reduced-price lunch scored higher, on average, than the TIMSS scale average, while average scores for students in schools with 50 percent or more students eligible for free or reduced-price lunch were not measurably different from the TIMSS scale average.

Average science scores in grade 4 and 8 for selected student groups in public schools in North Carolina: 2011

	Science	
Reporting groups	**Grade 4**	**Grade 8**
TIMSS scale average	**500**	**500**
U.S. average	**544 ***	**525 ***
North Carolina average	**538 ***	**532 ***
Sex		
Female	534 *	526 *
Male	543 *	537 *
Race/ethnicity		
White	565 *	565 *
Black	492	481 *
Hispanic	519 *	502
Asian	590 *	577 *
Multiracial	553 *	513
Percentage of pubic school students eligible for free or reduced-price lunch		
Less than 10 percent	‡	595 *
10 to 24.9 percent	574 *	569 *
25 to 49.9 percent	555 *	538 *
50 to 74.9 percent	534 *	518
75 percent or more	498	504

‡ Reporting standards not met.
*$p<.05$. Difference between score and TIMSS scale average is significant.
NOTE: Black includes African American, Hispanic includes Latino, and Asian includes Pacific Islander and Native Hawaiian. Racial categories exclude Hispanic origin. Not all race/ethnicity categories are shown, but they are all included in the U.S. and state totals shown throughout the report. The standard errors of the estimates are shown in table E-42 available at http://nces.ed.gov/pubsearch/pubsinfor.asp?pubid=2013009.
SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Average science scores of 4th-grade students, by education system: 2011

Grade 4		Grade 4	
Education system	**Average score**	**Education system**	**Average score**
TIMSS scale average	500	New Zealand	497 ▼
Korea, Rep. of	587 ▲	Kazakhstan[1]	495 ▼
Singapore[1]	583 ▲	Norway[4]	494 ▼
Finland	570 ▲	Chile	480 ▼
Japan	559 ▲	Thailand	472 ▼
Russian Federation	552 ▲	Turkey	463 ▼
Chinese Taipei-CHN	552 ▲	Georgia[3,5]	455 ▼
United States[1]	**544**	Iran, Islamic Rep. of	453 ▼
Czech Republic	536 ▼	Bahrain	449 ▼
Hong Kong-CHN[1]	535 ▼	Malta	446 ▼
Hungary	534 ▼	Azerbaijan[1,5]	438 ▼
Sweden	533 ▼	Saudi Arabia	429 ▼
Slovak Republic	532 ▼	United Arab Emirates	428 ▼
Austria	532 ▼	Armenia	416 ▼
Netherlands[2]	531 ▼	Qatar[1]	394 ▼
England-GBR	529 ▼	Oman	377 ▼
Denmark[1]	528 ▼	Kuwait[3,6]	347 ▼
Germany	528 ▼	Tunisia[6]	346 ▼
Italy	524 ▼	Morocco[7]	264 ▼
Portugal	522 ▼	Yemen[7]	209 ▼
Slovenia	520 ▼		
Northern Ireland-GBR[2]	517 ▼	**Benchmarking education systems**	
Ireland	516 ▼	*Florida-USA[3,8]*	545
Croatia[1]	516 ▼	*Alberta-CAN[1]*	541
Australia	516 ▼	*North Carolina-USA[1,3]*	538
Serbia[1]	516 ▼	*Ontario-CAN*	528 ▼
Lithuania[1,3]	515 ▼	*Quebec-CAN*	516 ▼
Belgium (Flemish)-BEL	509 ▼	*Dubai-UAE*	461 ▼
Romania	505 ▼	*Abu Dhabi-UAE*	411 ▼
Spain	505 ▼		
Poland	505 ▼		

▲ Average score is higher than U.S. average score.
▼ Average score is lower than U.S. average score.
[1]National Defined Population covers 90 to 95 percent of National Target Population (see appendix A).
[2]Met guidelines for sample participation rates only after replacement schools were included.
[3]National Target Population does not include all of the International Target Population (see appendix A).
[4]Nearly satisfied guidelines for sample participation rates after replacement schools were included.
[5]Exclusion rates for Azerbaijan and Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.
[6]The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 15 percent, though it is less than 25 percent.
[7]The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 25 percent.
[8]National Defined Population covers less than 90 percent, but at least 77 percent of National Target Population (see appendix A).
NOTE: Education systems are ordered by 2011 average score. Italics indicate participants identified and counted in this report as an education system and not as a separate country. Participants that did not administer TIMSS at the target grade are not shown; see the international report for their results. All U.S. state data are based on public school students only. All average scores reported as higher or lower than the U.S. average score are different at the .05 level of statistical significance. The tests for significance take into account the standard error for the reported difference. Thus, a small difference between the United States and one education system may be significant while a large difference between the United States and another education system may not be significant. The standard errors of the estimates are shown in table E-22 available at
http://nces.ed.gov/pubsearch/pubsinfor.asp?pubid=2013009.
SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Average science scores of 8th-grade students, by education system: 2011

Grade 8		Grade 8	
Education system	**Average score**	**Education system**	**Average score**
TIMSS scale average	500	Saudi Arabia	436 ▼
Singapore[1]	590 ▲	Malaysia	426 ▼
Chinese Taipei-CHN	564 ▲	Syrian Arab Republic	426 ▼
Korea, Rep. of	560 ▲	*Palestinian Nat'l Auth.*	420 ▼
Japan	558 ▲	Georgia[4,5]	420 ▼
Finland	552 ▲	Oman	420 ▼
Slovenia	543 ▲	Qatar	419 ▼
Russian Federation[1]	542 ▲	Macedonia, Rep. of	407 ▼
Hong Kong-CHN	535 ▲	Lebanon	406 ▼
England-GBR[2]	533	Indonesia	406 ▼
United States[1]	**525**	Morocco	376 ▼
Hungary	522	Ghana[6]	306 ▼
Australia	519		
Israel[3]	516	**Benchmarking education systems**	
Lithuania[4]	514 ▼	*Massachusetts-USA*[1,4]	567 ▲
New Zealand	512 ▼	*Minnesota-USA*[4]	553 ▲
Sweden	509 ▼	*Alberta-CAN*[1]	546 ▲
Italy	501 ▼	*Colorado-USA*[4]	542 ▲
Ukraine	501 ▼	*Indiana-USA*[1,4]	533
Norway	494 ▼	*Connecticut-USA*[1,4]	532
Kazakhstan	490 ▼	*North Carolina-USA*[3,4]	532
Turkey	483 ▼	*Florida-USA*[1,4]	530
Iran, Islamic Rep. of	474 ▼	*Ontario-CAN*[1]	521
Romania	465 ▼	*Quebec-CAN*	520
United Arab Emirates	465 ▼	*California-USA*[1,4]	499 ▼
Chile	461 ▼	*Alabama-USA*[4]	485 ▼
Bahrain	452 ▼	*Dubai-UAE*	485 ▼
Thailand	451 ▼	*Abu Dhabi-UAE*	461 ▼
Jordan	449 ▼		
Tunisia	439 ▼		
Armenia	437 ▼		

▲ Average score is higher than U.S. average score.
▼ Average score is lower than U.S. average score.
[1]National Defined Population covers 90 to 95 percent of National Target Population (see appendix A).
[2]Nearly satisfied guidelines for sample participation rates after replacement schools were included.
[3]National Defined Population covers less than 90 percent, but at least 77 percent of National Target Population (see appendix A).
[4]National Target Population does not include all of the International Target Population (see appendix A).
[5]Exclusion rates for Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.
[6]The TIMSS International Study Center has reservations about the reliability of the average achievement score because the percentage of students with achievement too low for estimation exceeds 15 percent, though it is less than 25 percent.
NOTE: Education systems are ordered by 2011 average score. Italics indicate participants identified and counted in this report as an education system and not as a separate country. Participants that did not administer TIMSS at the target grade are not shown; see the international report for their results. All U.S. state data are based on public school students only. All average scores reported as higher or lower than the U.S. average score are different at the .05 level of statistical significance. The tests for significance take into account the standard error for the reported difference. Thus, a small difference between the United States and one education system may be significant while a large difference between the United States and another education system may not be significant. The standard errors of the estimates are shown in table E-23 available at http://nces.ed.gov/pubsearch/pubsinfor.asp?pubid=2013009.
SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2011.

Science Performance in the United States and Internationally

Average scores in 2011

In science, the U.S. national average score was 544 at grade 4 and 525 at grade 8 (tables 26 and 27). Both scores were higher than the TIMSS scale average of 500 at both grades.

Among the 45 *countries* that participated at grade 4, the U.S. average science score was among the top 6 (5 countries had higher average scores than the United States). Thirty-nine countries had lower average scores than the United States.

Among all 57 *education systems* that participated at grade 4 (i.e., both countries and other education systems, including U.S. states that participated in TIMSS with individual state samples), the United States was among the top 10 in average science scores (6 education systems had higher averages and 3 were not measurably different). Korea, Singapore, Finland, Japan, the Russian Federation, and Chinese Taipei-CHN had higher average scores than the United States; and Florida-USA, Alberta-CAN, and North Carolina-USA had average scores not measurably different from the U.S. average at grade 4. The United States outperformed 47 education systems.

At grade 8, among the 38 *countries* that participated in TIMSS, the U.S. average science score was among the top 10 (6 countries had higher averages and 3 had averages not measurably different from the United States). Twenty-eight countries had lower average scores than the United States.

Among all 56 *education systems* that participated at grade 8, the United States was among the top 23 education systems in average science scores (12 education systems had higher averages and 10 were not measurably different). Singapore, Massachusetts-USA, Chinese Taipei-CHN, Korea, Japan, Minnesota-USA, Finland, Alberta-CAN, Slovenia, the Russian Federation, Colorado-USA, and Hong Kong-CHN had higher average scores than the United States; and England-GBR, Indiana-USA, Connecticut-USA, North Carolina-USA, Florida-USA, Hungary, Ontario-CAN, Quebec-CAN, Australia, and Israel had average scores not measurably different from the U.S. average at grade 8. The United States had higher average science scores than 33 education systems.

Change in scores

Several education systems that participated in TIMSS 2011 also participated in the last administration of TIMSS in 2007 or in the first administration of TIMSS in 1995. Some education systems participated in both of these previous administrations. Comparing scores between previous administrations of TIMSS and the most recent administration provides perspective on change over time.[17]

Change at grade 4 between 2007 and 2011

Among the 28 education systems that participated in both the 2007 and 2011 TIMSS science assessments at grade 4, the average science score increased in 9 education systems and decreased in 5 education systems (figure 9). In the rest, including the United States, there was no measurable change in the average grade 4 science scores between 2007 and 2011.

The education systems in which 4th-graders' average scores increased between 2007 and 2011 were Georgia (37 points), Tunisia (27 points), the Czech Republic (21 points), Norway (17 points), the Islamic Republic of Iran (17 points), Denmark (11 points), Japan (11 points), Sweden (9 points), and the Netherlands (8 points). None of these increases changed these education systems' standing relative to the United States between 2007 and 2011.[18]

Scores decreased at grade 4 during this time in Hong Kong-CHN (19 points), England-GBR (13 points), Australia (12 points), Italy (11 points), and New Zealand (7 points). As a result, U.S. average performance at grade 4 went from below the average of Hong Kong-CHN in 2007 to higher than that country's average in 2011, and from not measurably different from the averages of England-GBR and Italy in 2007 to higher than their averages in 2011.[19]

[17] Several participating countries that are reported with the 2011 results in other tables in this report are excluded from these comparisons based on International Study Center (ISC) review of assessment results. Morocco and Yemen participated in both 2007 or 1995 and 2011 at grade 4, but had unreliable 2011 science scores. Armenia, Kazakhstan, and Qatar also participated in both 2007 and 2011 at grade 4, but their 2007 science scores were not comparable to their 2011 scores. Armenia, Qatar, Saudi Arabia, and Turkey participated in both 2007 and 2011 at grade 8, but their 2007 science scores were not comparable to their 2011 scores. Similarly, Italy, Kuwait, and Thailand participated in both 1995 and 2011 at grade 4 and 8, but their 1995 science scores were not comparable to their 2011 scores.

[18] Although the average score of the Russian Federation did not increase measurably, its standing relative to the United States moved from being not measurably different in 2007 to scoring above the United States in 2011.

[19] Although the average score of Hungary and Ontario-CAN did not decrease measurably, their standing relative to the United States moved from being not measurably different in 2007 to scoring below the United States in 2011.