CHAPTER 3

TEACHING AND CURRICULUM

KEY POINTS

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.

U.S. eighth-grade students were less likely than their international peers to be taught mathematics by teachers who majored in mathematics, but as likely as others to be taught by teachers who majored in mathematics education.

U.S. eighth-grade students were as likely as their international peers to be taught science by teachers with a college major or main area of study in biology, chemistry, or science education but less likely to be taught science by teachers with a degree in physics.

A greater percentage of U.S. eighth-graders than of their international peers reported using computers frequently in mathematics and science classes.

U.S. eighth-grade students spent less time than their international peers studying mathematics or science outside of school and doing mathematics or science homework outside of school.

Chapter 3—Teaching and Curriculum

Researchers, practitioners, and policymakers have paid a great deal of attention to the preparation, ongoing professional development, instructional practices, and curricular focus of teachers. Much of this attention has focused on developing programs, teaching methods, and curriculum materials to improve the achievement of all students. TIMSS–R collected data from students, teachers, and schools about systems, programs, curricular emphases, instructional practices, and other factors that have been put into place to support improved student learning.

The relationships between achievement and education-related background factors are complex. In this initial report, it was not possible to explore the potential relationships between achievement and the context of teaching, learning, and curriculum in the United States and the other participating nations with the care and thought needed to be confident in our interpretations. Therefore, although this report presents findings on the context of teaching, learning, and curriculum in the United States and the 37 other nations that participated in TIMSS–R in 1999, it does not relate any changes or differences in achievement to these background factors. Examination of these factors is included to stimulate discussion of the many varied approaches taken by nations. More in-depth analyses of the data that take into account the complex systems that support student learning, as well as findings from the data-rich TIMSS Video Study and the forthcoming TIMSS–R Videotape Classroom Study, will provide a better basis for understanding these interconnections and will lead to important findings.

This chapter is organized into three sections, in the following order:

- findings on the preparation and qualifications of mathematics and science teachers, as well as their ongoing professional development activities;
- findings on the intended and implemented mathematics and science curricula; and
- findings on classroom practices and activities.

The analyses that follow are limited to data collected in 1999 for the 38 TIMSS–R nations. For some analyses in science, comparisons are limited to the nations that generally organized science instruction as a single, general/integrated subject or as separate subjects in 1999. Unless otherwise indicated, the 38 TIMSS–R nations are compared in the science analyses in this chapter. A list of the nations that generally organized science instruction as a general/integrated subject or as separate subjects at the eighth grade are provided in table A4.1 in appendix 4.

Teacher Preparation, Qualifications, and Professional Development

TIMSS–R collected information on the academic preparation, qualifications, and ongoing professional development of the mathematics and science teachers of eighth-grade students. Teachers' educational backgrounds and confidence in their abilities to teach mathematics and science were some of the factors considered as indicators of the extent to which teachers are prepared to teach. Data collected in TIMSS–R do not, however, provide a complete picture of teacher preparedness.

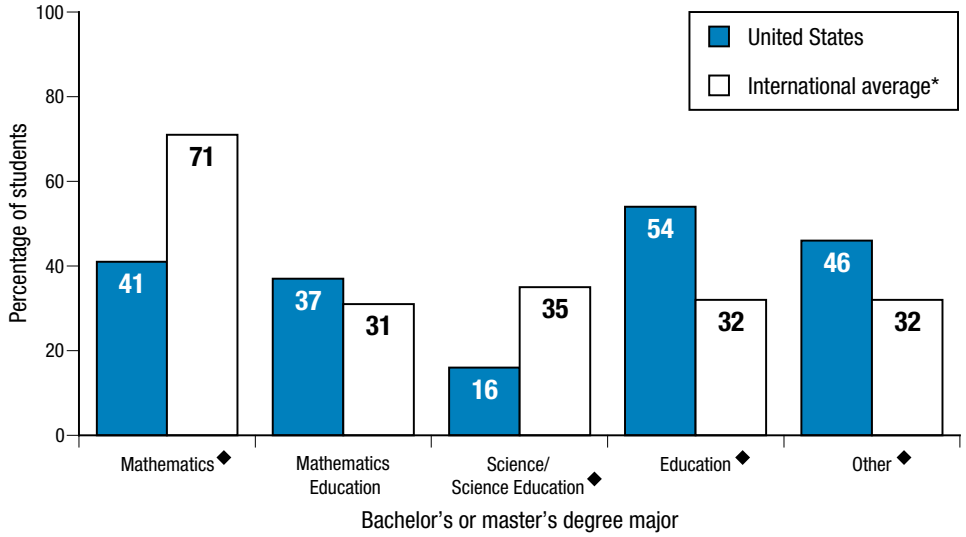
What educational backgrounds did our mathematics teachers have in 1999?

Over the last several years, some have argued that it is important for teachers to have subject matter expertise, and one indication of this is a major in subjects they teach, either at the bachelor's or master's level. TIMSS–R asked the mathematics and science teachers of eighth-grade students about their majors at the bachelor's and master's level. Teachers could indicate that they had more than one major or main area of study if applicable. U.S. eighth-grade students were less likely than their international peers to be taught by a mathematics teacher with a bachelor's or master's degree majoring in mathematics. In 1999, 41 percent of U.S. eighth-grade students had a mathematics teacher whose bachelor's degree or master's major

or main area of study was in mathematics, a smaller percentage than the international average of 71 percent of students (figure 25). Compared to the United States, a higher percentage of students in 29 of the 37 other nations were taught by a mathematics teacher with a bachelor's or master's or equivalent major in mathematics. Canada and Italy were the only nations that reported lower percentages than the United States.

U.S. eighth-grade students were as likely as their international peers to be taught by a mathematics teacher with a bachelor's or master's degree major in mathematics education. Thirty-seven percent of U.S. eighth-grade students were taught mathematics by a teacher whose bachelor's or master's major was in mathematics education. This is comparable to the international average of 31 percent of students.

Figure 25.—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. See Mullis et al. (2000) for details.
◆Significant difference between U.S. average and international average in this category.

NOTE: Science includes biology, physics, chemistry, and science education.
Based on 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 appendix 2 for details.
The international average is the average of the national averages of the nations that reported data.

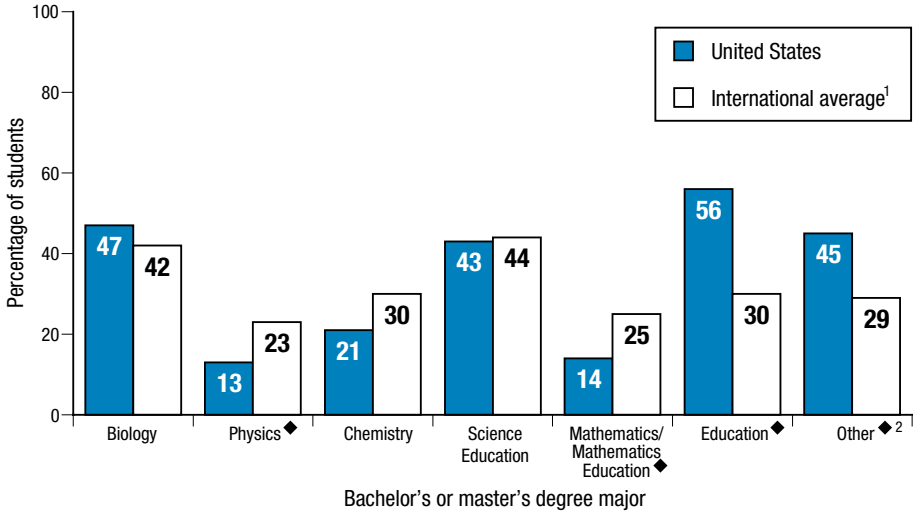
SOURCE: Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade*. Exhibit R3.1. Chestnut Hill, MA: Boston College.

What educational backgrounds did our science teachers have in 1999?

For this analysis, science teachers of U.S. students were compared to science teachers in other nations that generally taught science as a general/integrated science curriculum.[1] In addition to the United States, 22 other nations indicated they generally teach their eighth-grade students with this type of a science curriculum (see table A4.1). Unlike mathematics teachers, science teachers often obtained degrees in the different content areas of science such as biology, physics, and chemistry. Therefore, it is important to compare the percentage of students whose teachers held a bachelor's or master's degree in one of these specific areas. Teachers could indicate that they had more than one major or main area of study, if applicable.

In 1999, 47 percent of U.S. eighth-grade students were taught by science teachers with a college major or main area of study in biology, 13 percent of our students were taught by science teachers with a college major or main area of study in physics, and 21 percent of our students were taught by science teachers with a college major or main area of study in chemistry (figure 26). The percentage of U.S. students taught by science teachers with a college major or main area of study in biology or chemistry was similar to the international averages for these categories, while the percentage of U.S. students taught science by teachers with a college major or main area of study in physics was lower than the international average.

Figure 26.—Eighth-grade science teachers' reports on their main area of study: 1999



◆Significant difference between U.S. average and international average in this category.
[1]The item response rate for this question was less than 70 percent in some nations. See Martin et al. (2000) for details.
[2]Other may include areas of study in earth science fields.

NOTE: Based on 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 appendix 2 for details.
The international average is the average of the national averages of the nations that reported teaching a general/integrated science curriculum.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade*. Exhibit R3.1. Chestnut Hill, MA: Boston College.

[1]The National Research Coordinator of each nation was asked to complete a questionnaire that, among other things, asked if science was taught as a general/integrated subject or as separate subjects such as Earth Science, Biology, Physics, and Chemistry. The Council of Chief State School Officers (CCSSO) supplied information for the United States. The United States is one of 23 nations in TIMSS–R that, in general, teaches science as a general/integrated subject at the eighth-grade level. The questionnaire did not distinguish between general science and integrated science. See table A4.1 in appendix 4.

In addition to, or in lieu of, content area–specific degrees, teachers can also major in science education. In 1999, 43 percent of U.S. eighth-grade science students were taught by science teachers with a bachelor's or master's degree major in science education. This was similar to the international average of 44 percent.

How confident were mathematics teachers in their preparation to teach mathematics subjects?

In addition to asking about the educational background of teachers, TIMSS–R asked teachers how confident they were to teach mathematics as a gauge of their own sense of preparedness.

In general, more U.S. teachers of eighth-grade students reported feeling very well prepared to teach mathematics compared to their counterparts in other nations in 1999. In mathematics, the United States was among the top group of nations in which a large percentage of its students were taught by teachers who reported feeling "very well prepared" to teach mathematics (figure 27). On average, 90 percent of U.S. eighth-graders had teachers who felt "very well prepared" to teach across the topics covered by the TIMSS–R mathematics framework. In this respect, the United States was similar to 9 nations and was higher than 25 nations as well as the international average.

Ninety percent or more of U.S. eighth-grade students were taught by teachers who reported they were "very well prepared" to teach 7 of the 12 topics asked about.[2] For the other 5 topics (*measurement–units, instruments, and accuracy; geometric figures–definitions and properties; geometric figures–symmetry*; *simple probabilities–understanding and calculations;* and *coordinate geometry*), 75 to 86 percent of U.S. eighth-graders were taught by mathematics teachers who felt "very well prepared" to teach these topics. For 11 of the 12 mathematics topics covered in TIMSS–R, the percentage of U.S. students taught by teachers who felt "very well prepared" exceeded the international average.

Interpretation of these data should take into account cultural and curricular issues, however. For example, teachers in some cultures may be more reserved about discussing their strengths and abilities. Teachers' reports on their confidence levels to teach a subject area may be influenced by cultural norms and expectations. Moreover, teachers' reports on their confidence levels may also reflect the emphases of the curricula they are expected to teach. For example, if the mathematics standards or curriculum emphasizes a particular set of topics and does not emphasize another set of topics, teachers may feel less prepared to teach those topics that they are not usually expected to present. Curricular issues are dealt with to a certain degree in TIMSS–R, and the areas emphasized in each nation's curriculum as well as the topics covered by teachers are discussed later in this chapter.[3] Cultural issues are outside the scope of TIMSS–R but can be found throughout the research literature.

[2]The 7 mathematics topics where 90 percent or more of U.S. eighth-grade students were taught by teachers who report they were "very well prepared" are *fractions, decimals, and percentages; ratios and proportions; perimeter, area, and volume; algebraic representation; evaluate and perform operations on algebraic expressions; solving linear equations and inequalities; representation and interpretation of data in graphs, charts, and tables.*

[3]TIMSS–R collected information from the mathematics and science teachers of the eighth-graders about the curricular topics covered and emphasized most in the classroom. TIMSS–R did not include an in-depth curriculum analysis, as in TIMSS.

Figure 27.—Teachers' beliefs about their preparation to teach mathematics and science: 1999

Percentage of eighth-grade students whose mathematics teachers reported feeling very well prepared to teach mathematics	
Nation	Percent
Macedonia, Republic of	92
United States	90
Cyprus	89
Slovak Republic	89
Jordan	88
Czech Republic	88
New Zealand	88
Romania	85
Australia	84
(Israel)[1]	84
Netherlands	84
Turkey	83
Finland	81
Iran, Islamic Republic of	81
Malaysia	81
Indonesia	81
Belgium-Flemish	80
Canada	79
Singapore	78
Chinese Taipei	78
Morocco	75
Latvia-LSS[2]	73
Hong Kong SAR	72
South Africa	71
Italy	69
Bulgaria	66
Moldova	64
Philippines	64
Korea, Republic of	61
Hungary	59
Tunisia	51
Slovenia	50
Chile	44
Thailand	32
Japan	23
England	—
Lithuania	—
Russian Federation	—
International average of 35 nations	73

Percentage of eighth-grade students whose science teachers reported feeling very well prepared to teach science	
Nation	Percent
Macedonia, Republic of	72
Czech Republic	64
Turkey	63
New Zealand	59
United States	58
Indonesia	58
Romania	57
Morocco	57
Cyprus	57
Jordan	57
Australia	55
(Israel)	55
South Africa	53
Netherlands	50
Finland	47
Belgium-Flemish	47
Bulgaria	46
Singapore	46
Canada	44
Italy	42
Chinese Taipei	42
Iran, Islamic Republic of	42
Philippines	41
Moldova	39
Latvia-LSS[2]	37
Hong Kong SAR	34
Tunisia	32
Korea, Republic of	31
Thailand	30
Hungary	29
Chile	29
Malaysia	22
Japan	17
England	—
Lithuania	—
Russian Federation	—
Slovak Republic	—
Slovenia	—
International average of 33 nations	46

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

— Data not available.

[1]The shading of Israel 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.

NOTE: Eighth grade in most nations. See appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines. See appendix 2 for details.
The international average is the average of the national averages of the nations that provided data.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit R3.2. Chestnut Hill, MA: Boston College; Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit R3.2. Chestnut Hill, MA: Boston College.

How confident were science teachers in their preparation to teach science subjects?

Overall, the picture of teacher confidence in presenting science topics appears different from the one described for mathematics. Fifty-eight percent of U.S. eighth-graders had science teachers who felt "very well prepared" to teach across the science topics covered in the TIMSS–R framework (figure 27). In comparison to the 37 other TIMSS–R nations, the United States was similar to 11 nations and was higher than 20 nations as well as the international average. It appears that science teachers reported feeling less confident about their preparedness to teach eighth-grade science topics than their mathematics counterparts when considering the international average percentage of students taught by a teacher who felt "very well prepared" to teach mathematics (73 percent) or science (46 percent), internationally.

Forty to sixty-five percent of U.S. eighth-grade students had science teachers who felt "very well prepared" to teach 9 of the 10 topics asked about. In only one topic area, *scientific methods and inquiry skills*, did science teachers of more than 80 percent of eighth-grade students in the United States feel "very well prepared" to teach.

Compared to the international average, the United States had a higher percentage of its students taught by science teachers who felt "very well prepared" to teach in 4 of the 10 science topic areas: *earth science–features; earth science–solar system; environmental and resource issues*; and *scientific methods and inquiry skills*. In the other 6 topic areas,[4] the United States was similar to the international average.

Again, interpretation of these data should take into account possible cultural and curricular issues that can affect teachers' reports of their confidence to teach subject-specific topics.

In what types of professional development activities did our mathematics teachers participate?

The United States asked mathematics and science teachers of TIMSS–R students to describe their professional development experiences during the 1998–99 school year, defined as June 1998 to May 1999. Only U.S. teachers were asked about their participation in 11 types of professional development activities[5]; thus, cross-national comparisons cannot be made.

Of the 11 types of professional development asked about in the U.S. teacher questionnaires, within-district workshops or institutes and courses for college credit were generally the most frequent types of activities that mathematics teachers of U.S. eighth-grade students participated in during the 1998–99 school year. On average, U.S. eighth-grade students were taught mathematics by teachers who attended 12 clock hours of within-district workshops or institutes and 9 clock hours of courses for college credit[6] over the course of a year. These professional development activities may or may not have been specifically mathematics-focused.

In what types of professional development activities did our science teachers participate?

The story appears similar for the science teachers of U.S. students. Of the 11 types of professional development activities asked about in the teacher questionnaires, within-district workshops or institutes and courses for college credit were generally the most frequent types of activities that science teachers of U.S. eighth-grade students participated in during the 1998–99 school year. On average,

[4]The 6 science topics where the United States had a similar percentage of students with teachers feeling "very well prepared" compared to the international average are *biology–human systems*; *biology–plant and animal life; chemistry–matter; chemistry–chemical reactivity; physics–types of energy;* and *physics–light*.

[5]U.S. mathematics and science teachers were asked about their participation in the following 11 types of professional development activities: within-district workshops or institutes; courses for college credit; out-of-district workshops and institutes; teacher collaboratives or networks; out-of-district conferences; immersion or internship activities; receiving mentoring, coaching, lead teaching, or observation; teacher resource centers; committees or task forces; teacher study groups; and other forms of organized professional development. These questions were not asked in any other nation in TIMSS–R.

[6]This average includes teachers who did not take any courses for college credit; therefore, the average hours spent in such courses by those teachers who took them may be underreported.

U.S. eighth-grade students were taught by a science teacher who attended around 12 clock hours of within-district workshops or institutes and 12 clock hours of courses for college credit. In addition, science teachers of U.S. eighth-grade students spent almost 7 clock hours in committees or task forces over the course of a year.

Did our mathematics teachers observe one another teaching?

Some research suggests that the experience of teachers observing other teachers can contribute to the sharing of good practices. TIMSS–R asked the mathematics and science teachers of U.S. eighth-grade students about the number of class periods they observed other teachers in the last year and the number of periods other teachers observed them in the past year. It is important to note that the questionnaire did not ask teachers about the purpose of their participation in observation activities. Again, this question was asked only of U.S. mathematics and science teachers.

In general, the mathematics teachers of U.S. eighth-grade students rarely participated in observational activities. On average, U.S. eighth-grade students were taught by mathematics teachers who spent 1 class period during the 1998–99 school year observing other teachers and who were observed by other teachers during 2 class periods. There were no differences in the average number of class periods mathematics teachers observed other teachers or were observed by other teachers based on years of teaching experience.

Did our science teachers observe one another teaching?

The science teachers of U.S. eighth-grade students also rarely participated in observational activities. On average, U.S. eighth-graders were taught by science teachers who observed other teachers for 1 class period during the 1998–99 school year and who were observed by other teachers for 1 class period. However, the situation was different for U.S. eighth-grade students whose science teachers had the fewest years of experience (0–5 years): their teachers spent approximately 3 periods observing other teachers, a greater number of periods than science teachers with more years of experience.

What topics were emphasized in professional development activities for U.S. mathematics teachers?

In addition to exploring the types of professional development activities in which teachers of U.S. eighth-grade students participated, the U.S. mathematics and science teacher questionnaires asked about the topics emphasized during professional development activities.

Overall, mathematics teachers of U.S. eighth-grade students reported their professional development activities emphasized curriculum more than any other topic. Mathematics teachers who stated their professional development activities emphasized curriculum either "quite a lot" or "a great deal" taught 64 percent of U.S. eighth-grade students (figure 28). This was a higher percentage than the percentage for any other topic asked about.

Figure 28.—Percentage of U.S. eighth-grade students taught by teachers that participated in professional development activities that emphasized different topics: 1999

Professional development topic	Percentage of U.S. 8th-grade students taught by teachers who said their professional development activities emphasized the topic "quite a lot" or "a great deal"	
	Mathematics	Science
Curriculum	64	59
Subject-specific teaching methods in mathematics or science	40	40
General teaching methods	38	44
Approaches to assessment	33	37
Use of technology in instruction	44	46
Strategies for teaching diverse student populations	21	23
Information on how students learn mathematics or science	21	23
Deepening teacher's knowledge of mathematics or science	28	50
Leadership development	16	19

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study–Repeat (TIMSS-R), unpublished tabulations, 1999.

What topics were emphasized in professional development activities for U.S. science teachers?

Professional development activities related to curriculum also appear to be most frequent among science teachers of U.S. eighth-grade students, followed closely by activities related to general teaching methods, use of technology in instruction, and deepening teachers' knowledge of science. Fifty-nine percent of eighth-grade students were taught by science teachers reporting their professional development activities emphasized curriculum either "quite a lot" or "a great deal" (figure 28). This percentage was similar to the percentage of eighth-grade students taught by science teachers reporting their professional development activities emphasized general teaching methods, using technology, and deepening teacher's knowledge of science.

CURRICULUM, CONTENT COVERAGE, AND EMPHASES

Data on teacher preparation and professional development provide information on the readiness of teachers to instruct students. Combining these data with information on what teachers present and how they present it gives us a more complete picture of teaching and learning experiences in classrooms around the world. The following sections discuss the structure and scope of U.S. mathematics and science curricula in comparison to other TIMSS–R nations, as well as the instructional practices of mathematics and science teachers in the participating nations.

Who sets the curriculum in TIMSS–R nations?

Most of the 38 TIMSS–R nations have implemented a national mathematics and science curriculum. Australia, Canada, and the United States are the three TIMSS–R nations with regionally or locally determined curricula. Curriculum is determined at the state or provincial level in Australia and Canada. Curriculum is determined at the local level in the United States. Throughout this report, we treat Australia, Canada, and the United States as if they each had a national curriculum, for comparative purposes. However, it is important to remember that these three nations do not have national curricula in mathematics and science.

How much of each TIMSS–R content area did the intended U.S. curriculum cover?

In an effort to better understand the mathematics and science achievement of eighth-grade students, TIMSS–R collected information on each nation's mathematics and science curricula as it was intended to be taught to students.[7] This information can put achievement results in perspective by revealing those content areas that most eighth-grade students have been exposed to in their educational experiences up to and including eighth grade, and those that they have not yet been exposed to.[8] For example, if the intended mathematics or science curriculum in a nation does not emphasize the topics in a particular content area, or only a select group of students is intended to learn a particular topic, then we would be less likely to expect that nation's students to perform well in that content area on TIMSS–R.

Across the five content areas in mathematics and the six content areas in science examined in TIMSS–R, the intended U.S. mathematics and science curricula appear to have had a higher percentage of overall coverage of the TIMSS–R content areas than the international average. In mathematics, 93 percent of the topics included in the content areas overall were intended to be taught to all or almost all (at least 90 percent) of U.S. students in 1999. The international average of intended coverage to all or almost all students was 75 percent of the topics in the five mathematics content areas. One hundred percent of the topics in three mathematics content areas—*fractions and number sense*; *measurement*; and *data representation, analysis, and probability*—were intended to be taught to all or almost all U.S. eighth-grade students. Eighty-five percent of the topics in *geometry* and 82 percent of the topics in *algebra* were intended to be covered.

Similarly, 86 percent of the topics in the six science content areas overall were intended to be taught to all or almost all (at least 90 percent) of U.S. students in 1999. The international average across the TIMSS–R nations was 62 percent. One hundred percent of the topics in five of the six science content areas—*earth science*; *biology*; *physics*; *environmental and resource issues*; and *scientific inquiry and the nature of science*—were intended to be taught to all or almost all U.S. eighth-grade students. Fifty percent of topics in *chemistry* were intended to be covered.

[7]Findings are based on information provided by each nation's National Research Coordinator (NRC). In the United States, this information was provided by the Council of Chief State School Officers.

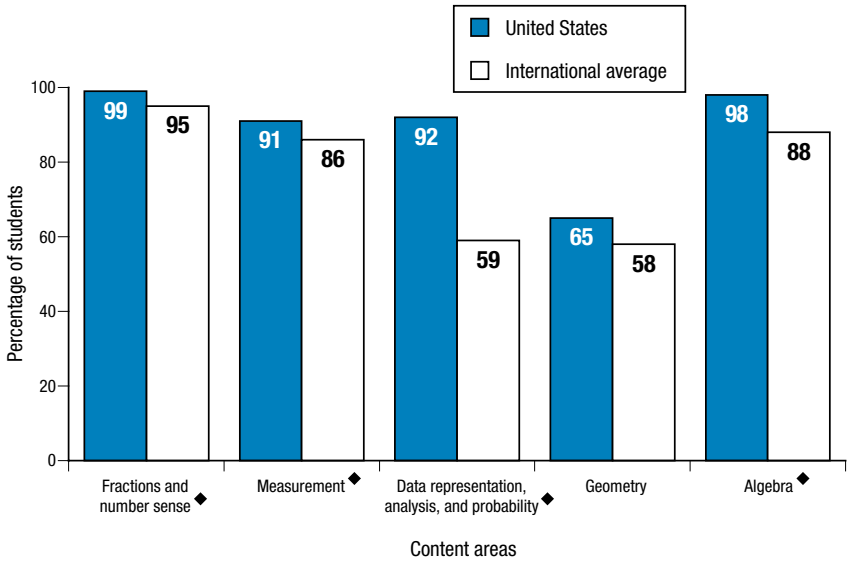
[8]Schmidt, McKnight, et al. (1997) and Schmidt, Raizen, et al. (1997) conducted in-depth analyses of the mathematics and science topics covered in the textbooks and curriculum guides used in nations as well as the depth of the topics presented. TIMSS–R did not collect information on the depth of coverage of topics by mathematics and science teachers. Comparisons between the findings of Schmidt et al. and TIMSS–R cannot be made here.

How much of the mathematics curriculum was taught?

TIMSS–R asked mathematics and science teachers of eighth-grade students about the curriculum that is actually taught in the classroom. Like information about the intended curriculum, information about what is actually taught can put achievement scores into perspective by revealing what content areas have and have not been covered by the time students near completion of the eighth grade.

The percentage of eighth-graders whose teachers reported they had taught each content area in mathematics and science varied across the TIMSS–R nations. "Taught" is defined as the sum of percentages of students whose teachers reported these areas as either taught before this year or taught more than five periods this year. Four of the five mathematics content areas—*fractions and number sense*; *measurement*; *data representation, analysis, and probability*; and *algebra*—were taught to between 91 percent and 99 percent of U.S. eighth-grade students, which was higher than the international average of the TIMSS-R nations for each of these content areas. On the other hand, 65 percent of U.S. eighth-grade students were taught *geometry* according to their mathematics teachers, a percentage similar to the international average (figure 29).

Figure 29.—Percentage of U.S. eighth-grade students "taught" mathematics content areas: 1999



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

NOTE: "Taught" equals the sum of percentages of students whose mathematics teachers reported these content areas as either "taught before this year" or "taught more than five periods this year."
Eighth grade in most nations. See appendix 2 for details.
The international average is the average of the national averages of the nations that reported data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study-Repeat (TIMSS-R), unpublished tabulations, 1999.

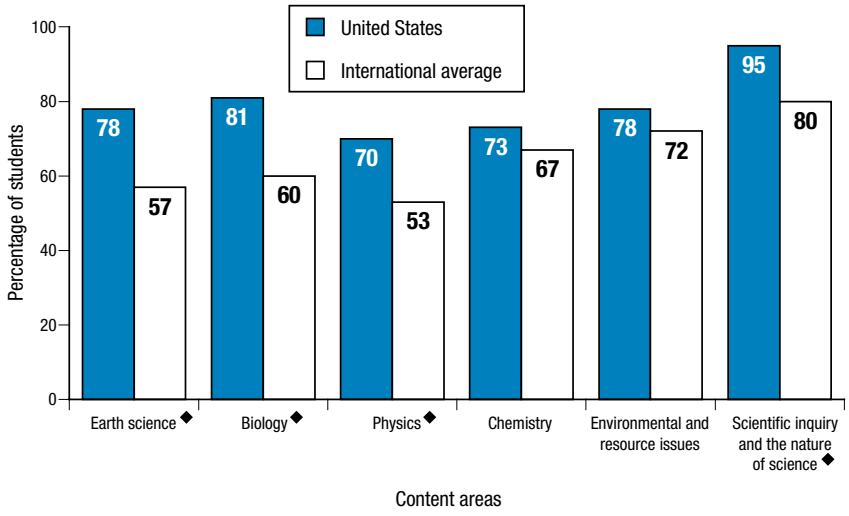
How much of the science curriculum was taught?

The percentage of U.S. eighth-grade students taught the six science content areas in TIMSS–R varied as well. Science teachers of 95 percent of U.S. eighth-graders reported that *scientific inquiry and the nature of science* was taught before the TIMSS–R assessment (figure 30). Science teachers of between 70 and 81 percent of U.S. eighth-graders reported that the other five content areas—*earth science*; *biology*; *physics*; *chemistry*; and *environmental and resource issues*—were taught before the assessment was given. Four of the six content areas—*earth science*; *biology*; *physics*; and *scientific inquiry and the nature of science*—were taught to a higher percentage of U.S. eighth-graders than the international averages for each of these four areas.

Which topics were emphasized most in U.S. eighth-grade curricula?

In 1999, a higher percentage of U.S. eighth-grade students had mathematics teachers who reported emphasizing *general mathematics* (28 percent) or *algebra* (27 percent) than the international averages of the 38 nations for each of these topics. U.S. eighth-grade students were less likely to be in classes where the emphasis was a combination of *algebra and geometry* or *algebra*, *geometry*, *numbers*, *and other topics* than the international average. No nation had a greater percentage of students taught by mathematics teachers who emphasized *algebra* as a single topic than the United States. That is, U.S. eighth-grade students were more likely to be in a mathematics class that emphasized *algebra* as a discrete topic than their international peers, who were more likely to be in mathematics classes that combine *algebra* with other topics such as *geometry*. Evidence from the TIMSS study showed that what is interpreted as *algebra* can vary among mathematics teachers from different nations (Stigler et al. 1999).

Figure 30.—Percentage of U.S. eighth-grade students "taught" science content areas: 1999



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

NOTE: "Taught" equals the sum of percentages of students whose science teachers reported these topics as either "taught before this year" or "taught more than five periods this year."
Eighth grade in most nations. See appendix 2 for details.
The international average is the average of the national averages of the nations that reported data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study-Repeat (TIMSS-R), unpublished tabulations, 1999.

The majority of U.S. eighth-grade students were in a science class where the teacher emphasized one of three subjects the most: *general/integrated science*, *earth science*, or *physical science*. Forty-one percent of U.S. eighth-grade students were in a class where *general/integrated science* was emphasized, which is lower than the international average (58 percent) of the nations that generally teach *general/integrated science*. The 28 percent of U.S. students whose teachers emphasized *earth science* was above the international average of 5 percent, and the 21 percent of U.S. eighth-grade students whose teachers emphasized *physical science* was also higher than the international average of 11 percent. Fewer U.S. eighth-grade students had teachers who emphasized *biology* (5 percent) or *physics* (2 percent) than the international averages (14 percent and 6 percent, respectively).

Did the TIMSS–R nations' curricula accommodate students with varying degrees of interests and abilities?

The United States was one of 30 TIMSS–R nations that addressed the issue of students having varying levels of interests and abilities in their mathematics curricula, and one of 27 nations that addressed differentiation in their science curricula.[9] The two most common approaches to addressing differentiation in mathematics and science classes were teaching the same curriculum to all students, with teachers adapting to different student needs, or "streaming" students by grade or ability level. These approaches have also been taken in the United States.

When schools were asked how their mathematics classes accommodated students with different abilities or interests in mathematics and science, schools of 79 percent of U.S. eighth-grade students responded that enrichment mathematics was offered, which was above the international average of 58 percent.[10] In science, schools of 34 percent of U.S. eighth-grade students said they offered enrichment science classes, a lower percentage than the international average of 50 percent. In addition, 64 percent of U.S. eighth-grade students were in schools that offered remedial mathematics, similar to the international average of 72 percent. Seventeen percent of U.S. eighth-grade students were in schools offering remedial science, a lower percentage than the international average of 53 percent.

CLASSROOM PRACTICES AND ACTIVITIES

TIMSS–R asked eighth-grade students and their mathematics and science teachers about various practices and activities that took place in the classroom, including use of calculators in mathematics lessons and use of computers and the Internet in science and mathematics lessons. The kinds of skills that students are asked to practice and the types of activities that they participate in during lessons can promote and reinforce learning, particularly when combined with a coherent and well-planned curriculum. Students' and teachers' reports of some of the practices and activities in the classroom are presented below.

What kinds of skills did U.S. mathematics and science teachers report asking their students to use during lessons?

Mathematics teachers of eighth-grade students were surveyed on whether they asked their students to perform each of the following in "most or every lesson": explain the reasoning behind an idea; represent and analyze relationships using tables, charts, or graphs; work on problems with no solution; write equations to represent relationships; and practice computational skills. A greater percentage of U.S. eighth-grade students were asked by their mathematics teachers to write equations to represent relationships in most or every lesson (54 percent) than the international average (43 percent). U.S. students were as likely to be asked by their mathematics teachers to practice each of the other skills as their international peers.

[9]Based on information provided by each nation's National Research Coordinator (NRC).

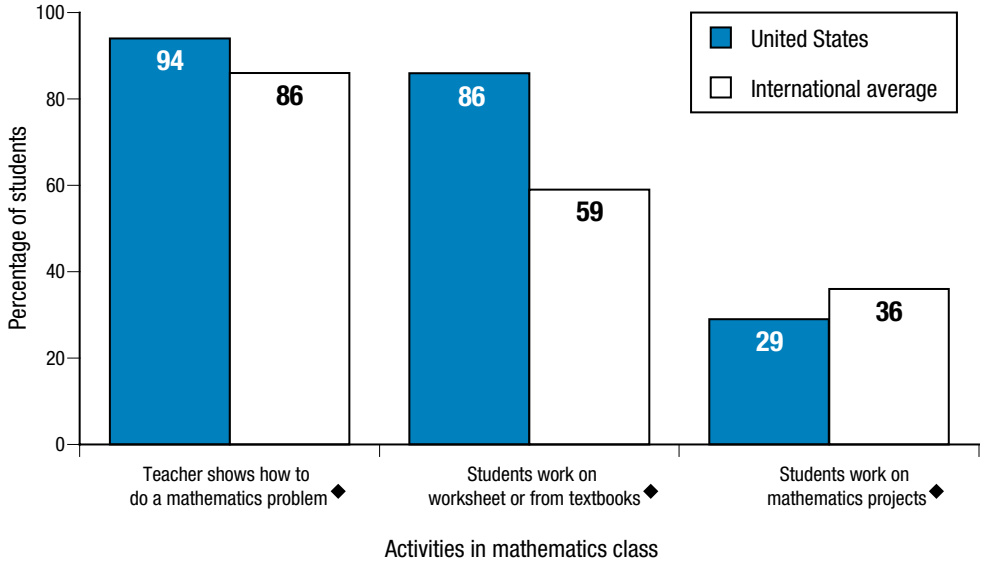
[10]School information provided by the principal or head administrator of the school.

A similar question was asked of science teachers in all 38 TIMSS–R nations. Science teachers reported on whether they asked their eighth-grade students in "most or every lesson" to explain the reasoning behind an idea; represent and analyze relationships using tables, charts, or graphs; work on problems with no solution; write explanations about what was observed and why it happened; or put events or objects in order. Eighty percent of U.S. eighth-grade students were asked by their science teachers to explain the reasoning behind an idea in most or every science lesson, a higher percentage than the international average of 67 percent of students. A majority of U.S. eighth-grade students (59 percent) were also asked by their science teachers to write explanations about what was observed and why it happened in most or every science lesson, which was similar to the international average of 52 percent. U.S. eighth-grade students were also as likely as their international peers to be asked to represent and analyze relationships, work on problems with no solution, and put events or objects in order in most or every science lesson.

What activities did U.S. students report occurring in their mathematics and science classes?

Students were asked to report on how often their mathematics teachers showed them how to do a mathematics problem, asked them to work from worksheets or textbooks on their own, asked them to work on mathematics projects, or asked them to use things from everyday life in solving mathematics problems. Ninety-four percent of U.S. eighth-grade students said that their teachers showed them how to do mathematics problems "almost always" or "pretty often" (figure 31). This was higher than the international average of 86 percent. Only one nation, Singapore, had a greater percentage of students report that their mathematics teachers showed them how to do a problem during the lesson almost always or pretty often than the United States. A greater percentage of U.S. eighth-grade students also reported that they worked from worksheets or textbooks on their

Figure 31.—Eighth-grade students' reports of the occurrence of selected activities in their mathematics class "almost always" or "pretty often": 1999



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

NOTE: Eighth grade in most nations. See appendix 2 for details.
The international average is the average of the national averages of the nations that reported data.

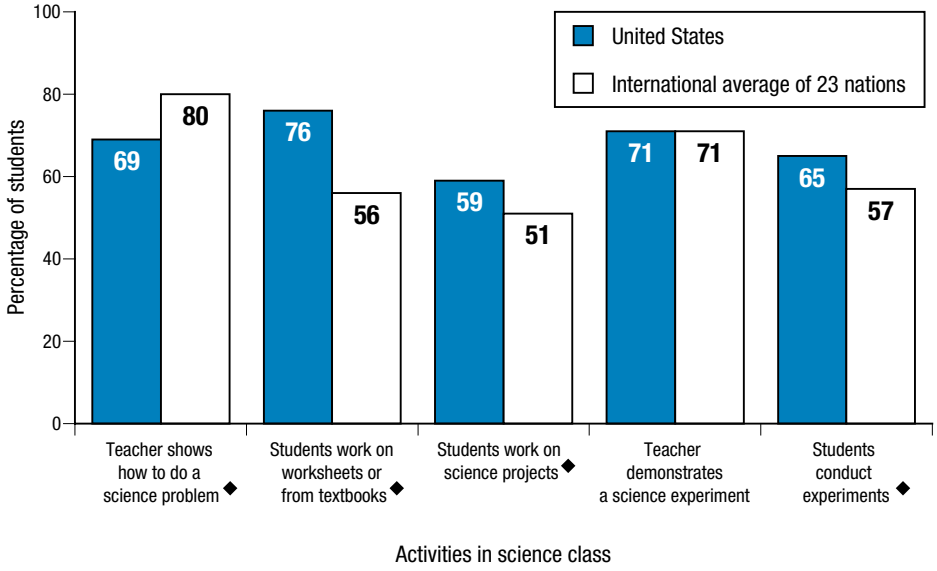
SOURCE: Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade*. Exhibit 6.11. Chestnut Hill, MA: Boston College.

own almost always or pretty often during mathematics lessons (86 percent) than the international average (59 percent). On the other hand, a smaller percentage of U.S. students reported that they worked on mathematics projects during their mathematics lessons (29 percent) than the international average (36 percent). Finally, TIMSS–R data indicate that 23 percent of U.S. eighth-grade students reported that they almost always use things from everyday life in solving mathematics problems during their mathematics lessons. This was a greater percentage than the international average of 15 percent (not included in figure).

Students were also asked to report on how often their science teachers showed them how to do a problem, asked them to work from worksheets or textbooks on their own, asked them to work on science projects, demonstrated an experiment in class, or asked students to conduct an experiment in class. In science, 69 percent of U.S. eighth-graders reported being shown how to do science problems by their science teachers "almost always" or "pretty often" during their science lessons (figure 32). This was a lower percentage than the international average (80 percent) of the 23 nations that teach an integrated/general science curriculum. Seventy-six percent of U.S. eighth-grade students also reported that they were almost always or pretty often asked to work from worksheets or textbooks and 59 percent stated that they work on science projects during science lessons, greater percentages than the international averages of 56 percent and 51 percent, respectively.

When students were asked how often their science teachers gave demonstrations of experiments, 71 percent of U.S. eighth-grade students reported that this occurred almost always or pretty often during their science lessons in 1999. Internationally, among the 23 nations with general/integrated science in eighth grade, an equivalent percentage of their international peers reported that their science teachers gave demonstrations of experiments during science lessons. When students were asked how often they did an

Figure 32.—Eighth-grade students' reports of the occurrence of selected activities in their science class "almost always" or "pretty often": 1999



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

NOTE: Eighth grade in most nations. See appendix 2 for details.
The international average is the average of the national averages of the 23 nations that reported teaching a general/integrated science curriculum in 1999.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade*. Exhibits 6.10, R3.11, and R3.13. Chestnut Hill, MA: Boston College.

experiment or practical investigation in their science lesson, 65 percent of U.S. eighth-graders reported that this occurred almost always or pretty often during their science lessons. This represented a higher percentage of students than the international average of 57 percent.

How often did U.S. students use calculators in their mathematics lessons?

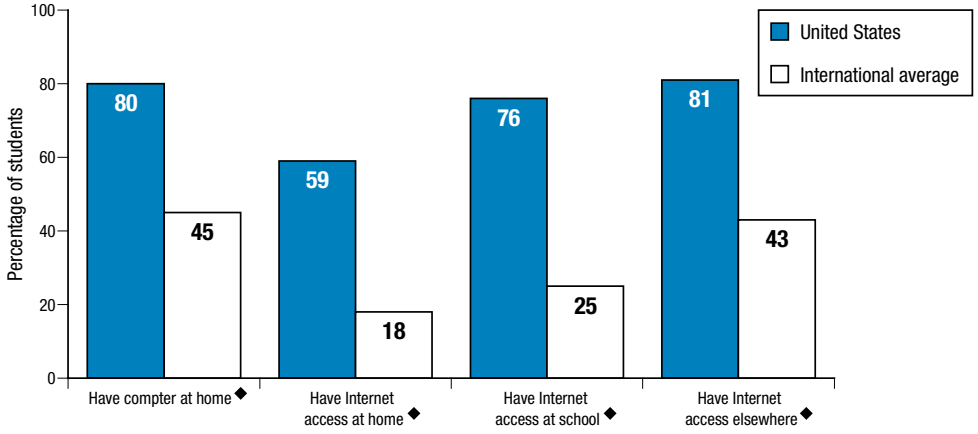
In 1999, 42 percent of U.S. eighth-grade students reported that they "almost always" used calculators in their mathematics lessons. This was a higher percentage of students than the international average (19 percent). In comparison to the United States, two nations—the Netherlands and Australia—had a higher percentage of students responding that they used calculators almost always in their mathematics lessons. Eight percent of U.S. eighth-grade students reported never using calculators in their mathematics lessons, which was lower than the international average of 32 percent of students.

Did students have access to computers and the Internet, and how did schools, teachers, and students report using these tools?

Some believe that access to computers, software, and the Internet provides additional tools for teachers to create meaningful lessons from which students can learn, helping to reinforce and supplement their classroom learning. In short, it is believed that these technological tools can, when coherently integrated into lessons, create additional opportunities for learning.

Access to computers and the Internet is the first step toward using these technological tools in teaching and learning mathematics and science. U.S. students had a high level of access to computers and the Internet at home and at school relative to eighth-graders in other nations in 1999. Eighty percent of U.S. eighth-graders reported that they had a computer in their home, a higher percentage than the international average of 45 percent (figure 33). Fifty-nine percent of U.S. eighth-grade students reported having Internet access at home,

Figure 33.—Eighth-grade students' reports of access to computers and the Internet: 1999



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

NOTE: Eighth grade in most nations. See appendix 2 for details.
The international average is the average of the national averages of the nations that reported data.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade*. Exhibits R1.1 and 6.17. Chestnut Hill, MA: Boston College.

76 percent reported access at school, and 81 percent reported access elsewhere (e.g., libraries or community centers); all of these percentages were greater than the international averages.

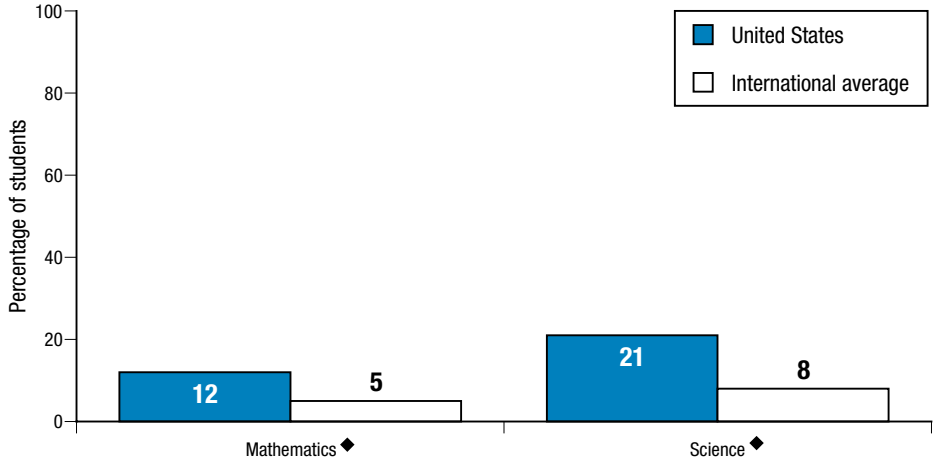
Access to computers, software, and the Internet and, by extension, their use in and for mathematics and science lessons, can be affected by shortages of these tools at school. Schools of 47 percent of U.S. eighth-grade students reported that shortages of computers for instruction affected mathematics instruction "some" or "a lot," similar to the international average of 57 percent. Schools of 45 percent of U.S. eighth-grade students also reported that shortages of computers for instruction affected science instruction "some" or "a lot," a smaller percentage than the international average of 59 percent. In regard to computer software, schools of almost half of U.S. eighth-grade students reported that shortages affected mathematics instruction and science instruction "some or a lot" (48 percent and 47 percent, respectively), which were similar to the international averages.

U.S. eighth-grade students were more than twice as likely as their peers in other nations to be in schools with networked computer access to the Internet. Ninety-one percent of U.S. eighth-grade students were in schools that reported Internet access, a higher percentage than the international average of 41 percent. Internationally, an average of 29 percent of students were in schools that reported they had no Internet access at all and no plans to get it—more than a quarter of all students surveyed internationally. Less than 1 percent of U.S. eighth-grade students were enrolled in a school that reported no access to the Internet and no plans to obtain access.

Access to computers and the Internet is one thing, but using them is another. Eighth-grade students were asked how often they use computers in their mathematics and science classes, and how often their teachers use computers to demonstrate ideas in class.

Twelve percent of U.S. eighth-graders reported using computers in mathematics class "almost always" or "pretty often" in 1999, which was a higher percentage than the international average of 5 percent (figure 34). Sixty-one percent of U.S. eighth-grade students reported that they never used computers in their mathematics classes,

Figure 34.—Eighth-grade students' reports on using computers in mathematics and science classes "almost always" or "pretty often": 1999



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

NOTE: Eighth grade in most nations. See appendix 2 for details.
The international average is the average of the national averages of the nations that reported data.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade*. Exhibit 6.15. Chestnut Hill, MA: Boston College; Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade*. Exhibit 6.18. Chestnut Hill, MA: Boston College.

which was below the international average of 80 percent. Nine percent of U.S. eighth-grade students reported that their teachers used computers to present mathematics ideas almost always or pretty often, which was higher than the international average of 5 percent.

Among U.S. eighth-graders who indicated access to the Internet, 13 percent reported they used e-mail to work with students in other schools on mathematics projects at least once a month, and 17 percent said that they used the World Wide Web to access information for mathematics projects at least once a month. A higher percentage of U.S. eighth-graders reported using the World Wide Web to access information for mathematics projects than the international average.

In science, 21 percent of U.S. eighth-graders reported using computers in science class "almost always" or "pretty often" in 1999, which was higher than the international average of 8 percent (figure 34).[11] Twenty percent of U.S. students reported their teachers used computers to present science ideas, which was higher than the international average of 10 percent.[12] Among U.S. eighth-grade students who indicated access to the Internet, 9 percent e-mailed students in other schools about science projects at least once a month, and 29 percent accessed information on the World Wide Web for science projects at least once a month. U.S. students' use of e-mail in this way for science-related projects was lower than the international average, and use of the Internet to access science information for science-related projects was higher than the international average.[13]

How often did U.S. students discuss completed homework or begin homework in their mathematics and science classes?

Many believe that homework is an important part of the learning process and that more homework leads to improvements in achievement. Prior TIMSS reports have not found a relationship between amount of homework assigned or hours spent on homework and achievement levels across nations (NCES, 1996, 1997c, 1998). That is, there was no consistent pattern of greater amounts of homework relating to higher achievement on TIMSS.

Homework can also be used to stimulate discussion in the classroom, however. TIMSS–R asked eighth-grade students how often they discuss their completed homework in their mathematics and science classes. A higher percentage of U.S. eighth-grade students reported that they discussed their completed homework during mathematics class than their international peers (figure 35). When asked whether they could begin their mathematics homework in class, a higher percentage of U.S. students reported that they could than students in 32 other nations. Seventy-four percent of U.S. eighth-graders reported that they "almost always" or "pretty often" could begin their mathematics homework during class compared to the international average of 42 percent.

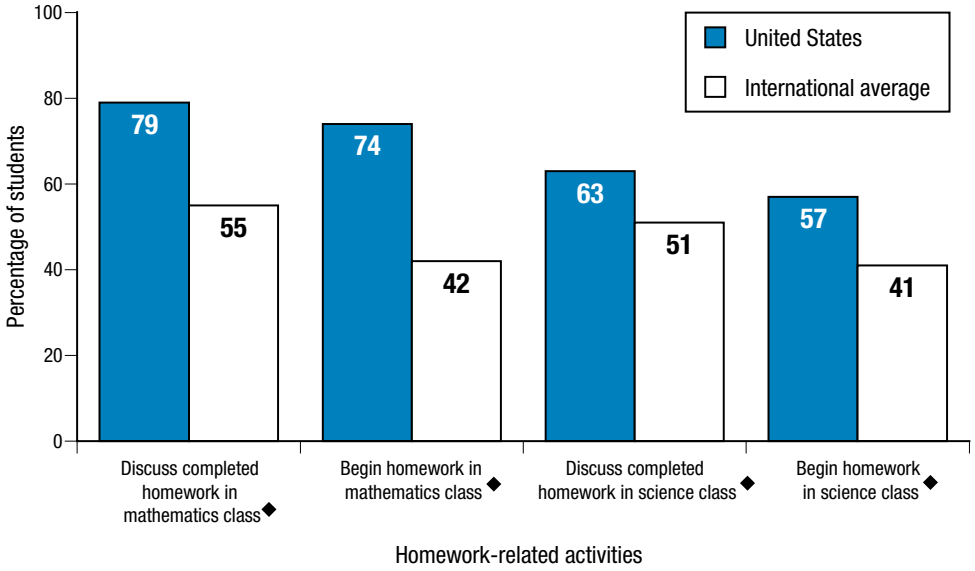
When compared to their peers in the 22 other nations that offer a general/integrated science curriculum, a higher percentage of U.S. eighth-grade students reported that they discussed their science homework in class than their peers in 15 nations. Sixty-three percent of U.S. eighth-graders reported that they "almost always" or "pretty often" discussed their completed science homework in class compared to the international average of 51 percent (figure 35). Among these same nations, the United States had a higher percentage of students who reported that they began their homework in science class than in 15 nations. Fifty-seven percent of U.S. eighth-grade students reported that they "almost always" or "pretty often" could begin their science homework during science class, compared to the international average of 41 percent.

[11]Comparisons among the 23 nations that generally teach general/integrated science.

[12]Comparisons among the 23 nations that generally teach general/integrated science.

[13]Comparisons among all 38 TIMSS–R nations.

Figure 35.—Eighth-grade students' reports of discussing or beginning homework in mathematics and science classes "almost always" or "pretty often": 1999



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

NOTE: Eighth grade in most nations. See appendix 2 for details.
The international average is the average of the national averages of the nations that reported data.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade*. Exhibit 6.10. Chestnut Hill, MA: Boston College; Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade*. Exhibit 6.11. Chestnut Hill, MA: Boston College.

How much time did U.S. students spend studying mathematics or doing mathematics homework outside of school?

On average, U.S. eighth-grade students spent less time outside of school studying mathematics or science and doing mathematics or science homework than their international peers.[14] U.S. students spent an average of approximately three-quarters of an hour on a normal school day either studying mathematics or doing mathematics homework, which is lower than their international peers, who spent an average of 1 hour. U.S. students spent about half an hour on science outside of school, less time than their peers in all TIMSS–R nations, who spent an average of 1 hour.

[14]This finding is consistent with prior reports on TIMSS. In an earlier NCES (1996) report, comparisons were made among Germany, Japan, and the United States only. Data published in Beaton et al. (1996a, 1996b) are also consistent with the numbers reported here.

CHAPTER 4

FUTURE DIRECTIONS

Chapter 4—Future Directions

The findings presented in this report examine the performance of U.S. eighth-grade students in comparison to their peers internationally. Most importantly, perhaps, this report documents the mathematics and science performance of our students between two points in time, a first for any international study. Regular participation in international data collections, such as TIMSS and TIMSS–R, provides an unprecedented opportunity to examine the pace of change in education in the United States and other nations over time, informing expectations of what can be achieved.

TIMSS and TIMSS–R were designed to document the mathematics and science performance of nations in comparison to one another. These studies were developed to document the systems put into place to support school mathematics and science teaching and learning in many different nations and the outcomes of these systems as measured on a set of items agreed upon at the international level. TIMSS and TIMSS–R were not specifically designed to indicate the success or failure of specific improvement efforts in the United States.

Of course, as with any study, the findings also raise many new questions, ones that can be pursued through future analyses of the TIMSS and TIMSS–R data, through analyses of other large-scale data sets such as NAEP, or through future data collections. This report presents an initial examination of the TIMSS and TIMSS–R data. Future reports are planned, and these will focus on more in-depth analyses of the data. In addition, each nation participating in TIMSS–R will release its own analysis of the data. Insights from each nation's findings can add to our understanding of what policies and practices may have contributed to observed changes in achievement. The TIMSS data set has been available for analysis by researchers, practitioners, and policymakers for some time. The TIMSS–R data set will also be made available in the first half of 2001. Finally, the results of the TIMSS–R Benchmarking Project involving 27 states, districts, and consortia of districts, available in April 2001, will provide an opportunity to examine eighth-grade mathematics and science achievement data at a more local level.

Among the many questions raised by the findings in this report are the following:

- Why did U.S. students' performance relative to the international average decrease as grade levels increase? What is happening in the intervening years between the fourth and eighth grades in the United States?
- Has the educational context for mathematics and science changed in the United States between 1995 and 1999?
- What education-related background factors are related to high achievement across nations? What education-related background factors are related to changes in achievement across nations over time?
- What is the relationship between performance in mathematics and performance in science at the student, school, and national levels?
- What is the relationship between international benchmarks of performance (e.g., top 10 percent) and the actual assessment items? Which items are students at or above the international top 10 percent benchmark likely to answer correctly? Which items are students at or above the international top 25 percent benchmark likely to answer correctly?
- In what areas of mathematics have black students in the United States been making progress? How does this progress relate to policies at the national, state, and local levels?
- What are possible reasons for the achievement gap in science between girls and boys in TIMSS–R? Did girls and boys differ in achievement on the content areas? How do these findings relate to decisions made at the national, state, and local levels?
- When controlling for other factors, how do different groups of U.S. students perform on TIMSS–R?
- What policies and practices have been instituted in nations that experienced significant increases and in those that experienced significant decreases in achievement? What is the relationship between these policies and practices and achievement?

Of course, there are many other questions that a study such as this raises. And some of the questions raised cannot be answered solely by examining data from TIMSS and TIMSS–R. It is expected, however, that further analyses of TIMSS and TIMSS–R will help address many of these questions and raise new ones to be pursued in future data collections. The additional components of TIMSS–R—that is, the TIMSS–R Videotape Classroom Study, the TIMSS–R Benchmarking Project, and the NAEP/TIMSS–R Linking Study—will add to the rich resources available for analysis and reflection. Moreover, it is hoped that TIMSS–R, including these component studies, will continue to stimulate discussion of the state of mathematics and science teaching and learning in the United States among researchers, policymakers, practitioners, parents, and students, much as TIMSS did.

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Appendix 1

TIMSS Publications

Appendix 1—TIMSS Publications

The following reports are intended to serve as examples of some of the numerous publications that have been produced in relation to the 1995 Third International Mathematics and Science Study (TIMSS). For an extended version of this list, please visit the NCES TIMSS web site at http://nces.ed.gov/timss/timss95.

TIMSS Summary and Achievement Reports

Beaton, A.E., Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Smith, T.A., and Kelly, D.L. (1996). *Science Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study*. Chestnut Hill, MA: Boston College.

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Appendix 2

Technical Notes

Appendix 2—Technical Notes

Sampling Information

TIMSS–R nations were asked to identify eligible students based on a common set of criteria, allowing for adaptation to nation-specific situations. The international desired population consisted of all students in the nation who were enrolled in the upper of the two adjacent grades that contained the greatest proportion of thirteen-year-olds at the time of testing. In the United States and most other nations, this corresponds to grade 8. If the national desired population of a nation fell below 65 percent, the nation's name is annotated to reflect this fact (table A2.1).

The international guidelines specified the following sampling standards:

- The sample was to be representative of at least 90 percent of students in the total population eligible for the study. Therefore, national exclusion rates were required to be less than 10 percent.
- The school participation rate without the use of replacement schools were required to be at least 50 percent, and
- School and student participation rates (after replacements) were required to be 85 percent or
- The combined participation rate (the product of school and student participation rates after replacements) were required to be at least 75 percent.

Nations were also required to submit a sampling plan for approval by the TIMSS International Study Center.

All deviations from the international guidelines are bolded in table A2.1.

A Note on U.S. Exclusion Rates

The reported exclusion rate for the United States for grade 8 TIMSS was 1.7 percent, and 3.9 percent for TIMSS–R. The difference in the exclusion rate for the United States between TIMSS and TIMSS–R may be explained as a difference in reporting procedures between the two studies, rather than an increase in the number of students declared not eligible to participate in the TIMSS–R assessment.

For the four nations that sampled more than one classroom per school, including the United States, exclusion of students could have occured at three levels: at the school level, at the classroom level, and at the student level. In the United States, there was negligible exclusion at the school level in both TIMSS and TIMSS–R. Tracking procedures accounted for exclusions of students within selected classes, but did not account for whole classroom exclusion. Thus, the reported U.S. TIMSS grade 8 exclusion rate of 1.7 percent covered only student-within-classroom exclusions, not whole classroom exclusions. It is likely, therefore, that this represents an underestimate of the overall exclusion rate.

For TIMSS–R, reporting procedures for exclusion rates in the United States were revised to permit tracking of excluded classrooms. Thus, the United States reports an exclusion rate within classrooms of 1.1 percent and a classroom exclusion rate of 2.8 percent in TIMSS–R, for a total within-school exclusion rate of 3.9 percent. The U.S. TIMSS–R exclusion rate is consistent with experience in the National Assessment of Educational Progress (NAEP) when accommodations are not offered. The available evidence thus points to no real change in the level of exclusion for the United States in TIMSS–R compared to TIMSS.

Weighting, Scaling and Plausible Values

Before the data were analyzed, responses from the groups of students assessed were assigned sampling weights to ensure that their representation in TIMSS–R results matched their actual percentage of the school population in the grade assessed. Based on these sampling weights, the analyses of TIMSS–R data were conducted in two major phases—scaling and estimation. During the scaling phase, item response theory (IRT) procedures were used to estimate the measurement characteristics of each assessment question. During the estimation phase, the results of the scaling were used to produce estimates of student achievement. Subsequent analyses related these achievement results to the background variables

Table A2.1.—Coverage of target population, by nation: 1999

Nation	Years of formal schooling	International desired population coverage	National desired population overall exclusion	School participation rate before replacement	Combined participation rate	Notes on sampling standards
Australia	8 or 9	100	2.5	84	85	
Belgium-Flemish	8	100	0.8	71	88	
Bulgaria	8	100	4.6	96	93	
Canada	8	100	6.0	94	93	
Chile	8	100	2.8	98	96	
Chinese Taipei	8	100	1.6	100	99	
Cyprus	8	100	0.8	100	97	
Czech Republic	9	100	5.2	96	95	
England	9	100	5.0	51	78	
Finland	7	100	3.7	97	96	
Hong Kong SAR	8	100	0.8	75	75	
Hungary	8	100	4.3	98	93	
Indonesia	8	100	0.0	88	97	
Iran, Islamic Republic of	8	100	4.4	96	98	
(Israel)	8	100	**16.1**	99	94	Exclusion rate over 10 percent
Italy	8	100	6.7	94	97	
Japan	8	100	1.3	93	89	
Jordan	8	100	3.0	99	99	
Korea	8	100	4.0	100	100	
Latvia-LSS[1]	8	61	4.0	97	91	Exclusion of 39 percent of student population (non-Latvian-speaking students)
Lithuania[2]	8.5	87	4.5	100	88	Exclusion of 13 percent of student population (non-Lithuanian-speaking students)
Macedonia, Republic of	8	100	1.1	99	98	
Malaysia	8	100	4.6	99	99	
Moldova	9	100	2.3	97	98	
Morocco	7	100	1.0	99	93	
Netherlands	8	100	0.6	58	82	
New Zealand	8.5 to 9.5	100	2.4	93	91	
Philippines	7	100	3.2	99	93	
Romania	8	100	3.7	98	97	
Russian Federation	7 or 8	100	1.7	98	96	
Singapore	8	100	0.0	100	98	
Slovak Republic	8	100	7.2	95	95	
Slovenia	8	100	3.0	98	94	
South Africa	8	100	2.3	84	82	
Thailand	8	100	3.3	95	99	
Tunisia	8	100	0.1	85	98	
Turkey	8	100	1.9	99	99	
United States	8	100	3.9	82	84	

[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.

SOURCE: Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibits 2, A.5, and A.8. Chestnut Hill, MA: Boston College.

Table A2.2.—Student and school samples and participation rates, by nation: 1999

Nation	Sample of schools	Sample of students	School participation after replacement (weighted)	Student participation (weighted)
Australia	170	4032	93	90
Belgium-Flemish	135	5259	89	97
Bulgaria	163	3272	97	96
Canada	385	8770	95	96
Chile	185	5907	100	96
Chinese Taipei	150	5772	100	99
Cyprus	61	3116	100	97
Czech Republic	142	3453	100	96
England	128	2960	85	90
Finland	159	2920	100	96
Hong Kong SAR	137	5179	76	98
Hungary	147	3183	98	95
Indonesia	150	5848	100	97
Iran, Islamic Republic of	170	5301	100	98
(Israel)	139	4195	100	94
Italy	180	3328	100	97
Japan	140	4745	93	95
Jordan	147	5052	100	99
Korea	150	6114	100	100
Latvia-LSS[1]	145	2873	98	93
Lithuania[2]	150	2361	100	89
Macedonia, Republic of	149	4023	99	98
Malaysia	150	5577	100	99
Moldova	150	3711	100	98
Morocco	173	5402	99	92
Netherlands	126	2962	85	95
New Zealand	152	3613	97	94
Philippines	150	6601	100	92
Romania	147	3425	98	98
Russian Federation	189	4332	100	97
Singapore	145	4966	100	98
Slovak Republic	145	3497	96	98
Slovenia	149	3109	99	95
South Africa	194	8146	91	93
Thailand	150	5732	100	99
Tunisia	149	5051	100	98
Turkey	204	7841	100	99
United States	221	9072	90	94

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

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

SOURCE: Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibits A.6, A.7, and A.8. Chestnut Hill, MA: Boston College.

collected by TIMSS–R. TIMSS–R data are extremely important in terms of the cost to obtain them and the reliance placed on the reports that use them. Therefore, the scaling and analysis of these data were carefully conducted and include extensive quality control checks.

Weighting—Responses from the groups of students were assigned sampling weights to adjust for over-representation or under-representation from a particular group. For example, the United States desired to report information on the achievement of students in public and nonpublic schools. This required that the United States over-sample nonpublic school students to get enough information for this group of students in order to do that. Sampling weights were applied to the data for public and nonpublic students in order to ensure that the U.S. student sample represents the overall eighth-grade student population. The use of sampling weights is necessary for the computation of statistically sound, nationally-representative estimators. The weight assigned to a student's responses is the inverse of the probability that the student would be selected for the sample.

When responses are weighted, none are discarded, and each contributes to the results for the total number of students represented by the individual student assessed. Weighting also adjusts for various situations such as school and student nonresponse because data cannot be assumed to be randomly missing. The internationally-defined weighting specifications for TIMSS–R require that each assessed student's sampling weight should be the product of (1) the inverse of the school's probability of selection, (2) an adjustment for school-level nonresponse, (3) the inverse of the classroom's probability of selection, and (4) an adjustment for student-level nonresponse. All TIMSS–R analyses are conducted using these sampling weights.

Scaling—TIMSS–R used Item Response Theory (IRT) methods to produce score scales that summarized the achievement results. With this method, the performance of a sample of students in a subject area or sub-area could be summarized on a single scale or a series of scales, even when different students had been administered different items. Because of the reporting requirements for TIMSS–R and because of the large number of background variables associated with the assessment, a large number of analyses had to be conducted. The procedures TIMSS–R used for the analyses were developed to produce accurate results for groups of students while limiting the testing burden on individual students. Furthermore, these procedures provided data that could be readily used in secondary analyses. IRT scaling provides estimates of item parameters (e.g., difficulty, discrimination) that define the relationship between the item and the underlying variable measured by the test. Parameters of the IRT model are estimated for each test question, with an overall scale being established as well as scales for each predefined content area specified in the assessment framework. For example, in 1999 the TIMSS–R assessment had five scales describing mathematics content strands, and science had scales for six fields of science.

TIMSS 1995 utilized a one parameter IRT model to produce score scales that summarized the achievement results. The TIMSS data were rescaled using a three parameter IRT model, to match the procedures used to scale the 1999 TIMSS–R data. The move from a one parameter model to a three parameter model was initiated to provide better estimates of student achievement. After careful study of the rescaling process, the International Study Center concluded that the fit between the original TIMSS data and the rescaled TIMSS data met acceptable standards. However, as a result of rescaling, the average achievement scores of some nations changed from those initially reported in 1996 (NCES 1996) and 1997 (NCES, 1997c). The rescaled TIMSS scores are reported here.

Plausible Values—During the scaling phase, plausible values were used to characterize scale scores for students participating in the assessment. To keep student burden to a minimum, TIMSS–R administered few assessment items to each student—too few to produce accurate content-related scale scores for each student. To account for this, for each student TIMSS–R generated five possible content-related scale scores that represented selections from the distribution of content-related scale scores of students with similar backgrounds who answered the assessment items the same way. The plausible-values technology is one way to ensure that the estimates of the average performance of student populations and the estimates of variability in those estimates are

more accurate than those determined through traditional procedures, which estimate a single score for each student. During the construction of plausible values, careful quality control steps ensured that the subpopulation estimates based on these plausible values were accurate. Plausible values were constructed separately for each national sample.

TIMSS–R uses the plausible-values methodology to represent what the true performance of an individual might have been, had it been observed, using a small number of random draws from an empirically derived distribution of score values based on the student's observed responses to assessment items and on background variables. Each random draw from the distribution is considered a representative value from the distribution of potential scale scores for all students in the sample who have similar characteristics and identical patterns of item responses. The draws from the distribution are different from one another to quantify the degree of precision (the width of the spread) in the underlying distribution of possible scale scores that could have caused the observed performances. The TIMSS–R plausible values function like point estimates of scale scores for many purposes, but they are unlike true point estimates in several respects. They differ from one another for any particular student, and the amount of difference quantifies the spread in the underlying distribution of possible scale scores for that student. Because of the plausible-values approach, secondary researchers can use the TIMSS–R data to carry out a wide range of analyses.

ITEM DEVELOPMENT AND REPLACEMENT

TIMSS–R utilized the same assessment framework designed for TIMSS. Approximately one third of the original 1995 TIMSS assessment items were kept secure so that they could be included in the 1999 TIMSS–R assessment to provide trend data. For the approximately two thirds of items that were released to the public, a panel of international assessment and content experts and the National Research Coordinators (NRCs) of each participating country developed and reviewed replacement items that closely matched the content of the original items. Through this process, over 300 science and mathematics items were developed as potential replacement items, of which 277 items were carefully chosen to be field tested. Approximately 1000 students per country participated in this field test.

All of the potential replacement items and the secured items, as well as the questionnaires, were field tested in 31 nations. Field test results for each item were carefully reviewed and examined for problems. Items that did not perform well during the field test—based on a clear set of criteria—were either revised to correct the problem or set aside. Of the 277 potential replacement items, 202 were selected based on the results of the field test. The item development process resulted in the replacement of TIMSS items released to the public with new items that had similar characteristics in terms of item format, performance expectation, content area, and difficulty level.

As a result, the TIMSS–R assessments consisted of 298 items—96 non-released items and 202 replacement items, organized into 26 blocks of items among 8 test booklets. A summary of item characteristics in TIMSS and TIMSS–R is provided below.

Table A2.3.—Number of items by item format in main survey: 1995 and 1999

Response type	TIMSS	TIMSS–R
Multiple choice	227	230
Free response	59	68
Total	286	298

SOURCE: Boston College, Third International Mathematics and Science Study–Repeat (TIMSS–R), Field Test Report, Table 8.1, 1999.

Table A2.4.—Number of mathematics items by content area in main survey: 1995 and 1999

Content area	TIMSS	TIMSS–R
Algebra	27	28
Data representation, analysis and probability	21	21
Fractions and number sense	51	52
Geometry	23	23
Measurement	18	20
Proportionality	11	11*
Total	151	155

*Proportionality items in TIMSS–R distributed among other content areas. Therefore, TIMSS–R does not report proportionality as a separate content area.

SOURCE: Boston College, Third International Mathematics and Science Study–Repeat (TIMSS–R), Field Test Report, Table 8.2, 1999.

Table A2.5.—Number of science items by content area in main survey: 1995 and 1999

Content area	TIMSS	TIMSS–R
Chemistry	19	19
Earth science	22	22
Life science	40	39
Physics	40	39
Environmental and resource issues *	6	12
Scientific inquiry and the nature of science*	8	12
Total	135	143

*The TIMSS–R Science Assessment reflects the inclusion of 10 new items in the areas of Environmental and Resource Issues and Scientific Inquiry and the Nature of Science. This will permit the results in these two content areas to be reported separately in TIMSS–R, which was not the case in TIMSS.

SOURCE: Boston College, Third International Mathematics and Science Study–Repeat (TIMSS–R), Field Test Report, Table 8.3, 1999.

TRANSLATION VERIFICATION

The TIMSS–R instruments were prepared in English and translated into the primary language or languages of instruction in each nation. In addition, it was sometimes necessary to adapt the instruments for cultural purposes, even in the nations that tested in English. Adaptations were approved by the International Study Center if they did not in any way change the substance or intent of the question or answer choices. For example, use of the word "weight" may be an unfamiliar colloquial term for "mass" to some students; a change from "weight" to "weight (mass)" would be an acceptable clarification in this case.

Each nation prepared translations of the instruments according to translation guidelines established by the International Study Center. Adaptations to the instruments were documented by each nation. The goal of the translation guidelines was to produce translated instruments of the highest quality that would provide comparable data across participating nations.

Translated instruments were verified by an independent, professional translation agency prior to final approval and printing of the instruments. Nations were required to submit copies of the final printed instruments administered in TIMSS–R to the International Study Center. Further details on the translation process can be found in the *TIMSS 1999 Technical Report* (Martin and Gregory, 2000).

ITEM SCORING

The TIMSS–R assessments items included both multiple choice and free-response items. The National Research Coordinator (NRC) in each nation was responsible for the scoring and coding of data in that nation, following established international guidelines. The NRC and, in some cases, additional staff, attended in-depth training sessions to introduce participants to the TIMSS–R coding system and to provide extensive practice in scoring example items. The training sessions were generally conducted over several days. Information on within-country agreement among coders was collected and documented by the International Study Center. A percentage of student responses in each nation were to be scored independently by two coders. Information on coding and scoring reliability was also used to calculate cross-country agreement among the coders. The International Study Center carefully monitored and documented the reliability of scoring within and across nations. The results of calculating reliability on scoring of the free-response items in each nation can be found in Martin et al. (2000) and Mullis et al. (2000). Further details on the item scoring process can be found in Martin and Gregory (2000).

TIMSS 1995 PARTICIPATING NATIONS

Table A2.6 describes the complete list of nations that participated in TIMSS 1995 at the fourth and eighth grades.

Table A2.6.—Fourth- and eighth-grade nations in TIMSS: 1995

	Nations that participated in TIMSS at eighth grade (1995)	Nations that participated in TIMSS at fourth grade (1995)
	(Australia)	(Australia)
	(Austria)	(Austria)
	Belgium-Flemish	
	(Belgium-French)	
	(Bulgaria)	
	Canada	Canada
	(Colombia)	
	Cyprus	Cyprus
	Czech Republic	Czech Republic
	(Denmark)	
	(England)	(England)
	France	
	(Germany)	
	(Greece)	Greece
	Hong Kong SAR	Hong Kong SAR
	Hungary	(Hungary)
	Iceland	Iceland
	Iran, Islamic Republic of	Iran, Islamic Republic of
	Ireland	Ireland
	(Israel)	(Israel)
	(Italy)[1]	(Italy)[1]
	Japan	Japan
	Korea, Republic of	Korea, Republic of
	(Kuwait)	(Kuwait)
	(Latvia-LSS)[2]	(Latvia-LSS)[2]
	(Lithuania)[3]	
	(Netherlands)	(Netherlands)
	New Zealand	New Zealand
	Norway	Norway
	Portugal	Portugal
	(Romania)	
	Russian Federation	
	(Scotland)	Scotland
	Singapore	Singapore
	Slovak Republic	
	(Slovenia)	(Slovenia)
	(South Africa)	
	Spain	
	Sweden	
	Switzerland	
	(Thailand)	(Thailand)
	United States	United States
Total Nations	42	27

[1]Italy was unable to provide the International Study Center at Boston College with their data in time for it to be included in the international reports for both the fourth and eighth grade in TIMSS 1995. However, their data for TIMSS 1995 appear in this report.

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

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

NOTE: Only nations that completed the necessary steps for their data to appear in the reports from the International Study Center at Boston College are listed.

Parentheses indicate nations not meeting international sampling and/or other guidelines at fourth, eighth or both grades in 1995. See NCES (1996) for details regarding eighth-grade data. See NCES (1997c) for details for fourth-grade data.

SOURCE: Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit A.1. Chestnut Hill, MA: Boston College.

Appendix 3

Supporting Data for Chapter 2

Appendix 3—Supporting Data for Chapter 2

Table A3.1.—Average mathematics and science achievement of eighth-grade students with standard errors, by nation: 1999

Mathematics		
Nation	Average	s.e.
Australia	525	4.8
Belgium-Flemish	558	3.3
Bulgaria	511	5.9
Canada	531	2.5
Chile	392	4.4
Chinese Taipei	585	4.0
Cyprus	476	1.8
Czech Republic	520	4.2
England	496	4.2
Finland	520	2.7
Hong Kong SAR	582	4.3
Hungary	532	3.7
Indonesia	403	4.9
Iran, Islamic Republic of	422	3.4
(Israel)	466	3.9
Italy	479	3.8
Japan	579	1.7
Jordan	428	3.6
Korea, Republic of	587	2.0
Latvia-LSS[1]	505	3.4
Lithuania[2]	482	4.3
Macedonia, Republic of	447	4.2
Malaysia	519	4.4
Moldova	469	3.9
Morocco	337	2.6
Netherlands	540	7.1
New Zealand	491	5.2
Philippines	345	6.0
Romania	472	5.8
Russian Federation	526	5.9
Singapore	604	6.3
Slovak Republic	534	4.0
Slovenia	530	2.8
South Africa	275	6.8
Thailand	467	5.1
Tunisia	448	2.4
Turkey	429	4.3
United States	502	4.0
International average of 38 nations	487	0.7

Science		
Nation	Average	s.e.
Australia	540	4.4
Belgium-Flemish	535	3.1
Bulgaria	518	5.4
Canada	533	2.1
Chile	420	3.7
Chinese Taipei	569	4.4
Cyprus	460	2.4
Czech Republic	539	4.2
England	538	4.8
Finland	535	3.5
Hong Kong SAR	530	3.7
Hungary	552	3.7
Indonesia	435	4.5
Iran, Islamic Republic of	448	3.8
(Israel)	468	4.9
Italy	493	3.9
Japan	550	2.2
Jordan	450	3.8
Korea, Republic of	549	2.6
Latvia-LSS[1]	503	4.8
Lithuania[2]	488	4.1
Macedonia, Republic of	458	5.2
Malaysia	492	4.4
Moldova	459	4.0
Morocco	323	4.3
Netherlands	545	6.9
New Zealand	510	4.9
Philippines	345	7.5
Romania	472	5.8
Russian Federation	529	6.4
Singapore	568	8.0
Slovak Republic	535	3.3
Slovenia	533	3.2
South Africa	243	7.9
Thailand	482	4.0
Tunisia	430	3.4
Turkey	433	4.3
United States	515	4.6
International average of 38 nations	488	0.7

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

[2]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 appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines. See appendix 2 for details.
The international average is the average of the national averages of the 38 nations.
s.e. means standard error.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 1.1. Chestnut Hill, MA: Boston College; Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 1.1. Chestnut Hill, MA: Boston College.

Table A3.2.—Percentiles of achievement in eighth-grade mathematics with standard errors, by nation: 1999

Nation	Percentages of students reaching international benchmarks							
	Top 10 percent		Top 25 percent		Top 50 percent		Top 75 percent	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
Australia	12	1.8	37	2.7	73	2.4	94	0.8
Belgium-Flemish	23	1.4	54	1.7	85	1.4	98	0.7
Bulgaria	11	2.3	30	3.0	66	2.6	91	1.3
Canada	12	1.1	38	1.5	77	1.3	96	0.6
Chile	1	0.5	3	1.1	15	1.8	48	2.0
Chinese Taipei	41	1.7	66	1.5	85	1.0	95	0.6
Cyprus	3	0.4	17	0.8	51	1.1	84	0.8
Czech Republic	11	1.4	33	2.1	69	2.3	94	1.1
England	7	0.9	24	1.9	58	2.1	89	1.3
Finland	6	0.9	31	1.7	75	1.5	96	0.5
Hong Kong SAR	33	2.3	68	2.4	92	1.5	99	0.6
Hungary	16	1.2	41	1.9	74	1.6	94	1.0
Indonesia	2	0.4	7	0.9	22	1.4	52	2.2
Iran, Islamic Republic of	1	0.2	5	0.8	25	1.7	63	1.5
(Israel)	5	0.6	18	1.3	47	1.8	77	1.9
Italy	5	0.7	20	1.4	52	2.1	83	1.4
Japan	33	1.1	64	1.0	89	0.5	98	0.3
Jordan	3	0.5	11	0.9	32	1.5	62	1.4
Korea, Republic of	37	1.0	68	0.9	91	0.5	99	0.2
Latvia-LSS[1]	7	0.9	26	1.8	63	2.0	92	1.0
Lithuania[2]	4	0.7	17	2.0	52	2.4	86	1.8
Macedonia, Republic of	3	0.4	12	1.0	38	1.9	72	1.8
Malaysia	12	1.4	34	2.4	69	2.2	94	0.8
Moldova	4	0.7	16	1.5	45	2.2	81	1.7
Morocco	0	0.0	0	0.2	5	0.4	27	1.1
Netherlands	14	2.3	45	4.1	81	3.5	96	1.3
New Zealand	8	1.2	25	2.4	56	2.5	85	1.5
Philippines	0	0.1	1	0.5	8	1.4	31	2.5
Romania	5	1.1	19	1.9	49	2.6	80	2.1
Russian Federation	15	1.8	37	2.8	72	2.7	94	1.2
Singapore	46	3.5	75	2.7	93	1.3	99	0.3
Slovak Republic	14	1.4	40	2.3	78	1.8	96	0.6
Slovenia	15	1.2	39	1.4	74	1.4	95	0.7
South Africa	0	0.2	1	0.4	5	1.0	14	2.0
Thailand	4	0.8	16	1.8	44	2.6	81	1.6
Tunisia	0	0.1	4	0.5	32	1.6	80	1.3
Turkey	1	0.3	7	1.0	27	1.9	65	2.0
United States	9	1.0	28	1.6	61	1.9	88	1.0

[1]Designated LSS because only Latvian-speaking schools were tested which represents 61 percent of the population.
[2]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 appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines. See appendix 2 for details.
s.e. means standard error.

SOURCE: Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 1.6. Chestnut Hill, MA: Boston College.

Table A3.3.—Percentiles of achievement in eighth-grade science with standard errors, by nation: 1999

Nation	Percentages of students reaching international benchmarks							
	Top 10 percent		Top 25 percent		Top 50 percent		Top 75 percent	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
Australia	19	1.6	43	2.3	74	2.0	93	0.9
Belgium-Flemish	11	1.4	39	1.6	76	1.7	96	1.3
Bulgaria	14	2.1	34	2.5	65	2.2	88	1.5
Canada	14	0.9	38	1.3	73	1.2	94	0.6
Chile	1	0.4	5	1.0	22	1.6	56	1.7
Chinese Taipei	31	1.9	58	2.0	83	1.3	95	0.7
Cyprus	2	0.5	12	0.8	39	1.6	74	1.4
Czech Republic	17	1.7	41	2.2	74	1.8	95	0.8
England	19	1.9	42	2.3	72	2.0	92	1.0
Finland	14	1.4	39	1.9	74	1.5	95	0.7
Hong Kong SAR	10	1.1	35	2.1	75	2.1	95	1.0
Hungary	22	1.4	49	1.7	79	1.4	95	0.8
Indonesia	1	0.3	6	0.9	27	1.6	64	2.4
Iran, Islamic Republic of	2	0.3	9	1.0	32	1.7	68	1.7
(Israel)	7	0.6	20	1.2	45	1.9	72	2.0
Italy	7	0.9	23	1.7	54	2.0	83	1.2
Japan	19	1.1	48	1.4	80	1.0	96	0.5
Jordan	4	0.5	15	1.0	38	1.5	66	1.6
Korea, Republic of	22	1.1	46	1.2	77	1.0	94	0.5
Latvia-LSS[1]	7	1.3	24	2.5	59	2.0	88	1.4
Lithuania[2]	6	0.9	20	1.9	51	2.1	83	1.8
Macedonia, Republic of	4	0.5	15	1.6	40	1.9	70	2.2
Malaysia	6	0.9	21	1.9	53	2.2	85	1.5
Moldova	4	0.5	15	1.2	39	1.8	70	1.6
Morocco	0	0.0	1	0.2	5	0.5	20	1.1
Netherlands	16	2.3	46	3.8	79	3.5	95	1.6
New Zealand	12	1.4	32	2.1	61	2.2	86	1.6
Philippines	1	0.3	3	0.7	13	1.7	31	2.6
Romania	6	0.8	19	1.9	45	2.5	75	2.1
Russian Federation	17	2.4	38	2.8	68	2.5	90	1.0
Singapore	32	3.3	56	3.5	80	2.6	94	1.4
Slovak Republic	14	1.4	39	2.0	74	1.7	94	0.7
Slovenia	16	1.1	39	1.7	71	1.5	93	0.7
South Africa	0	0.2	2	0.6	6	1.4	13	2.0
Thailand	3	0.7	15	2.0	47	2.5	84	1.3
Tunisia	0	0.1	3	0.4	19	1.5	62	2.0
Turkey	1	0.2	6	0.8	25	1.8	62	2.4
United States	15	1.2	34	1.9	62	2.0	85	1.3

[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.

NOTE: Eighth grade in most nations. See appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines. See appendix 2 for details.
s.e. means standard error.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 1.6. Chestnut Hill, MA: Boston College.

Table A3.4.—Average eighth-grade achievement in mathematics content areas with standard errors, by nation: 1999

Fractions and number sense			Measurement			Data representation, analysis, and probability			Geometry			Algebra		
Nation	Average	s.e.	Nation	Average	s.e.	Nation	Average	s.e.	Nation	Average	s.e.	Nation	Average	s.e.
Australia	519	4.3	Australia	529	4.9	Australia	522	6.3	Australia	497	5.7	Australia	520	5.1
Belgium-Flemish	557	3.1	Belgium-Flemish	549	4.0	Belgium-Flemish	544	3.8	Belgium-Flemish	535	4.1	Belgium-Flemish	540	4.6
Bulgaria	503	6.6	Bulgaria	497	6.6	Bulgaria	493	6.1	Bulgaria	524	5.9	Bulgaria	512	5.1
Canada	533	2.5	Canada	521	2.4	Canada	521	4.5	Canada	507	4.7	Canada	525	2.4
Chile	403	4.9	Chile	412	4.9	Chile	429	3.8	Chile	412	5.4	Chile	399	4.3
Chinese Taipei	576	4.2	Chinese Taipei	566	3.4	Chinese Taipei	559	5.1	Chinese Taipei	557	5.8	Chinese Taipei	586	4.4
Cyprus	481	3.0	Cyprus	471	4.0	Cyprus	472	4.6	Cyprus	484	4.6	Cyprus	479	1.6
Czech Republic	507	4.8	Czech Republic	535	5.0	Czech Republic	513	5.9	Czech Republic	513	5.5	Czech Republic	514	4.0
England	497	3.8	England	507	3.8	England	506	8.0	England	471	4.2	England	498	4.9
Finland	531	3.8	Finland	521	4.7	Finland	525	3.8	Finland	494	6.0	Finland	498	3.1
Hong Kong SAR	579	4.5	Hong Kong SAR	567	5.8	Hong Kong SAR	547	5.4	Hong Kong SAR	556	4.9	Hong Kong SAR	569	4.5
Hungary	526	4.2	Hungary	538	3.5	Hungary	520	5.9	Hungary	489	4.3	Hungary	536	4.1
Indonesia	406	4.1	Indonesia	395	5.1	Indonesia	423	4.4	Indonesia	441	5.1	Indonesia	424	5.7
Iran, Islamic Republic of	437	4.5	Iran, Islamic Republic of	401	4.7	Iran, Islamic Republic of	430	6.0	Iran, Islamic Republic of	447	2.9	Iran, Islamic Republic of	434	4.9
(Israel)	472	4.4	(Israel)	457	5.1	(Israel)	468	5.1	(Israel)	462	5.4	(Israel)	479	4.5
Italy	471	5.0	Italy	501	5.0	Italy	484	4.5	Italy	482	5.6	Italy	481	3.6
Japan	570	2.6	Japan	558	2.4	Japan	555	2.3	Japan	575	5.1	Japan	569	3.3
Jordan	432	3.2	Jordan	438	4.4	Jordan	436	7.8	Jordan	449	7.1	Jordan	439	5.3
Korea, Republic of	570	2.7	Korea, Republic of	571	2.8	Korea, Republic of	576	4.2	Korea, Republic of	573	3.9	Korea, Republic of	585	2.7
Latvia-LSS[1]	496	3.7	Latvia-LSS[1]	505	3.5	Latvia-LSS[1]	495	4.8	Latvia-LSS[1]	522	5.6	Latvia-LSS[1]	499	4.3
Lithuania[2]	479	4.3	Lithuania[2]	467	4.0	Lithuania[2]	493	3.6	Lithuania[2]	496	5.8	Lithuania[2]	487	3.7
Macedonia, Republic of	437	4.7	Macedonia, Republic of	451	5.2	Macedonia, Republic of	442	6.2	Macedonia, Republic of	460	6.1	Macedonia, Republic of	465	4.0
Malaysia	532	4.7	Malaysia	514	4.6	Malaysia	491	4.0	Malaysia	497	4.4	Malaysia	505	4.8
Moldova	465	4.2	Moldova	479	4.9	Moldova	450	5.7	Moldova	481	5.0	Moldova	477	3.7
Morocco	335	3.6	Morocco	348	3.5	Morocco	383	3.5	Morocco	407	2.2	Morocco	353	4.7
Netherlands	545	7.1	Netherlands	538	5.8	Netherlands	538	7.9	Netherlands	515	5.5	Netherlands	522	7.7
New Zealand	493	5.0	New Zealand	496	5.3	New Zealand	497	5.0	New Zealand	478	4.2	New Zealand	497	4.7
Philippines	378	6.3	Philippines	355	6.2	Philippines	406	3.5	Philippines	383	3.4	Philippines	345	5.8
Romania	458	5.7	Romania	491	4.9	Romania	453	4.7	Romania	487	6.4	Romania	481	5.2
Russian Federation	513	6.4	Russian Federation	527	6.0	Russian Federation	501	4.8	Russian Federation	522	6.0	Russian Federation	529	4.9
Singapore	608	5.6	Singapore	599	6.3	Singapore	562	6.2	Singapore	560	6.7	Singapore	576	6.2
Slovak Republic	525	4.8	Slovak Republic	537	3.3	Slovak Republic	521	4.6	Slovak Republic	527	7.3	Slovak Republic	525	4.6
Slovenia	527	3.7	Slovenia	523	3.7	Slovenia	530	4.2	Slovenia	506	6.2	Slovenia	525	2.9
South Africa	300	6.0	South Africa	329	4.8	South Africa	356	3.8	South Africa	335	6.6	South Africa	293	7.7
Thailand	471	5.3	Thailand	463	6.2	Thailand	476	4.0	Thailand	484	4.4	Thailand	456	4.9
Tunisia	443	2.8	Tunisia	442	3.1	Tunisia	446	5.1	Tunisia	484	4.4	Tunisia	455	2.7
Turkey	430	4.3	Turkey	436	6.5	Turkey	446	3.3	Turkey	428	5.7	Turkey	432	4.6
United States	509	4.2	United States	482	3.9	United States	506	5.2	United States	473	4.4	United States	506	4.1
International average of 38 nations	487	0.7	International average of 38 nations	487	0.7	International average of 38 nations	487	0.7	International average of 38 nations	487	0.7	International average of 38 nations	487	0.7

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

[2]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 appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines. See appendix 2 for details.
The international average is the average of the national averages of the 38 nations.
s.e. means standard error.
SOURCE: Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 3.1. Chestnut Hill, MA: Boston College.

Table A3.5.—Average eighth-grade achievement in science content areas with standard errors, by nation: 1999

Earth science			Life science			Physics			Chemistry			Environmental and resource issues			Scientific inquiry and the nature of science		
Nation	Average	s.e.	Nation	Average	s.e.	Nation	Average	s.e.	Nation	Average	s.e.	Nation	Average	s.e.	Nation	Average	s.e.
Australia	519	6.1	Australia	530	4.4	Australia	531	6.3	Australia	520	5.0	Australia	530	6.3	Australia	535	4.9
Belgium-Flemish	533	3.5	Belgium-Flemish	535	4.6	Belgium-Flemish	530	3.5	Belgium-Flemish	508	3.3	Belgium-Flemish	513	3.5	Belgium-Flemish	526	4.9
Bulgaria	520	5.7	Bulgaria	514	6.9	Bulgaria	505	5.8	Bulgaria	527	5.7	Bulgaria	483	6.4	Bulgaria	479	5.6
Canada	519	3.7	Canada	523	3.8	Canada	521	3.8	Canada	521	5.4	Canada	521	3.5	Canada	532	5.1
Chile	435	7.0	Chile	431	3.7	Chile	428	5.6	Chile	435	5.2	Chile	449	4.8	Chile	441	4.7
Chinese Taipei	538	3.0	Chinese Taipei	550	3.3	Chinese Taipei	552	3.9	Chinese Taipei	563	4.3	Chinese Taipei	567	4.0	Chinese Taipei	540	4.9
Cyprus	459	5.4	Cyprus	468	3.8	Cyprus	459	2.9	Cyprus	470	3.4	Cyprus	475	4.3	Cyprus	467	4.6
Czech Republic	533	6.9	Czech Republic	544	4.1	Czech Republic	526	4.2	Czech Republic	512	5.2	Czech Republic	516	5.7	Czech Republic	522	5.7
England	525	3.9	England	533	6.2	England	528	4.5	England	524	5.5	England	518	5.8	England	538	5.1
Finland	520	5.5	Finland	520	4.0	Finland	520	4.4	Finland	535	4.5	Finland	514	7.1	Finland	528	4.0
Hong Kong SAR	506	4.3	Hong Kong SAR	516	5.5	Hong Kong SAR	523	4.9	Hong Kong SAR	515	5.2	Hong Kong SAR	518	4.9	Hong Kong SAR	531	2.8
Hungary	560	3.9	Hungary	535	4.0	Hungary	543	4.3	Hungary	548	4.7	Hungary	501	6.6	Hungary	526	5.9
Indonesia	431	6.4	Indonesia	448	3.6	Indonesia	452	5.5	Indonesia	425	3.9	Indonesia	489	4.8	Indonesia	446	4.3
Iran, Islamic Republic of	459	5.2	Iran, Islamic Republic of	437	3.7	Iran, Islamic Republic of	445	5.7	Iran, Islamic Republic of	487	4.1	Iran, Islamic Republic of	470	5.5	Iran, Islamic Republic of	446	5.3
(Israel)	472	5.2	(Israel)	463	4.0	(Israel)	484	5.3	(Israel)	479	4.7	(Israel)	458	4.0	(Israel)	476	8.3
Italy	502	5.9	Italy	488	4.6	Italy	480	4.1	Italy	493	4.8	Italy	491	5.4	Italy	489	4.6
Japan	533	6.2	Japan	534	5.4	Japan	544	2.9	Japan	530	3.1	Japan	506	5.5	Japan	543	2.8
Jordan	446	3.5	Jordan	448	4.1	Jordan	459	3.6	Jordan	483	5.5	Jordan	476	6.0	Jordan	440	5.5
Korea, Republic of	532	2.7	Korea, Republic of	528	3.6	Korea, Republic of	544	5.1	Korea, Republic of	523	3.7	Korea, Republic of	523	4.5	Korea, Republic of	545	7.3
Latvia-LSS[1]	495	5.4	Latvia-LSS[1]	509	3.9	Latvia-LSS[1]	495	3.9	Latvia-LSS[1]	490	3.7	Latvia-LSS[1]	493	5.2	Latvia-LSS[1]	495	4.7
Lithuania[2]	476	4.4	Lithuania[2]	494	4.6	Lithuania[2]	510	4.3	Lithuania[2]	485	4.6	Lithuania[2]	458	5.1	Lithuania[2]	483	6.4
Macedonia, Republic of	464	4.2	Macedonia, Republic of	468	4.9	Macedonia, Republic of	463	6.0	Macedonia, Republic of	481	6.1	Macedonia, Republic of	432	4.2	Macedonia, Republic of	464	3.6
Malaysia	491	4.2	Malaysia	479	5.4	Malaysia	494	4.1	Malaysia	485	3.5	Malaysia	502	4.4	Malaysia	488	4.5
Moldova	466	4.2	Moldova	477	3.9	Moldova	457	5.5	Moldova	451	5.6	Moldova	444	6.2	Moldova	471	3.9
Morocco	363	3.3	Morocco	347	2.8	Morocco	352	4.2	Morocco	372	4.8	Morocco	396	5.1	Morocco	391	4.2
Netherlands	534	7.2	Netherlands	536	7.2	Netherlands	537	6.5	Netherlands	515	6.4	Netherlands	526	8.5	Netherlands	534	6.5
New Zealand	504	5.8	New Zealand	501	5.6	New Zealand	499	4.7	New Zealand	503	4.9	New Zealand	503	5.2	New Zealand	521	6.8
Philippines	390	5.0	Philippines	378	5.7	Philippines	393	6.3	Philippines	394	6.5	Philippines	391	7.6	Philippines	403	5.5
Romania	475	5.5	Romania	475	6.0	Romania	465	6.8	Romania	481	6.1	Romania	473	6.6	Romania	456	5.5
Russian Federation	529	5.1	Russian Federation	517	6.5	Russian Federation	529	6.3	Russian Federation	523	8.0	Russian Federation	495	6.6	Russian Federation	491	4.9
Singapore	521	7.3	Singapore	541	7.2	Singapore	570	6.7	Singapore	545	8.3	Singapore	577	8.3	Singapore	550	5.9
Slovak Republic	537	4.3	Slovak Republic	535	6.2	Slovak Republic	518	4.1	Slovak Republic	525	4.9	Slovak Republic	512	4.5	Slovak Republic	507	3.9
Slovenia	541	4.3	Slovenia	521	3.9	Slovenia	525	4.4	Slovenia	509	5.4	Slovenia	519	3.4	Slovenia	513	4.3
South Africa	348	4.8	South Africa	289	7.3	South Africa	308	6.7	South Africa	350	4.0	South Africa	350	8.5	South Africa	329	6.4
Thailand	470	3.9	Thailand	508	4.5	Thailand	475	4.2	Thailand	439	4.3	Thailand	507	3.0	Thailand	462	4.2
Tunisia	442	2.7	Tunisia	441	5.0	Tunisia	425	6.3	Tunisia	439	3.7	Tunisia	462	5.0	Tunisia	451	3.4
Turkey	435	4.6	Turkey	444	4.5	Turkey	441	4.0	Turkey	437	5.0	Turkey	461	3.6	Turkey	445	6.3
United States	504	4.2	United States	520	4.1	United States	498	5.5	United States	508	4.8	United States	509	6.4	United States	522	4.3
International average of 38 nations	488	0.9	International average of 38 nations	488	0.7	International average of 38 nations	488	0.9	International average of 38 nations	488	0.8	International average of 38 nations	488	0.7	International average of 38 nations	488	0.7

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

[2]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 appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines. See appendix 2 for details.
The international average is the average of the national averages of the 38 nations.
s.e. means standard error.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 3.1. Chestnut Hill, MA: Boston College.

Table A3.6.—Percent correct on mathematics assessment item examples with standard errors, by nation: 1999

Nation	Percentage of students responding correctly									
	Figure 6		Figure 7		Figure 8		Figure 9		Figure 10	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
Australia	91	0.8	55	1.8	29	2.0	36	2.3	37	2.4
Belgium-Flemish	96	0.7	65	2.0	42	1.7	70	2.7	62	1.9
Bulgaria	86	1.6	52	3.2	22	2.6	49	3.1	41	3.0
Canada	93	0.7	58	1.6	32	1.8	36	3.0	42	2.6
Chile	65	1.3	7	1.2	5	1.0	23	1.8	8	1.2
Chinese Taipei	89	0.7	75	1.4	50	1.8	61	1.8	66	1.7
Cyprus	85	1.1	41	1.9	21	1.8	30	3.1	34	1.8
Czech Republic	91	1.0	46	2.9	34	2.5	40	3.0	46	2.8
England	92	1.0	48	2.3	17	1.9	43	2.9	34	2.3
Finland	91	1.0	57	2.3	28	2.0	53	3.2	32	2.3
Hong Kong SAR	93	0.7	78	1.6	34	1.8	60	2.4	62	2.3
Hungary	93	0.9	45	2.0	35	2.1	39	2.4	46	2.0
Indonesia	54	1.6	20	1.4	5	0.5	22	1.7	14	1.2
Iran, Islamic Republic of	58	1.5	25	2.0	9	0.7	23	1.8	14	1.1
(Israel)	83	1.6	28	1.8	19	1.5	35	2.8	30	1.8
Italy	77	1.9	48	2.1	27	1.7	41	2.2	24	1.5
Japan	95	0.5	80	1.2	39	1.5	73	1.7	53	1.7
Jordan	66	1.5	26	1.5	12	1.1	35	2.2	13	1.3
Korea, Republic of	93	0.6	78	1.3	52	1.5	56	2.1	61	1.2
Latvia-LSS[1]	87	1.4	44	2.5	35	2.1	39	2.9	32	2.4
Lithuania[2]	84	1.5	35	2.4	25	2.0	35	3.0	23	2.1
Macedonia, Republic of	79	1.4	25	1.9	17	1.3	36	2.7	16	1.6
Malaysia	88	0.8	56	1.9	19	1.4	49	2.5	32	1.8
Moldova	66	1.6	38	2.6	16	1.8	40	3.0	26	1.9
Morocco	43	1.2	8	0.9	2	0.4	26	1.8	5	0.6
Netherlands	95	0.8	55	4.7	25	2.7	39	3.5	38	2.5
New Zealand	88	1.0	41	2.3	18	1.7	27	2.3	32	2.3
Philippines	53	1.6	6	1.0	3	0.7	13	1.4	9	0.9
Romania	73	1.8	43	2.7	20	2.2	48	3.2	38	3.0
Russian Federation	83	1.9	49	2.8	30	2.4	49	2.9	40	2.7
Singapore	97	0.5	83	1.5	57	2.1	67	2.4	72	2.5
Slovak Republic	90	1.1	57	2.5	36	2.3	49	2.9	53	3.0
Slovenia	92	0.8	49	2.1	36	2.1	53	2.5	37	1.9
South Africa	37	1.6	3	0.7	1	0.3	15	1.3	4	1.0
Thailand	77	1.5	33	2.1	21	1.8	22	2.0	20	1.7
Tunisia	67	1.3	38	1.6	9	0.8	38	2.2	10	1.0
Turkey	74	1.3	20	1.7	10	1.3	29	1.8	20	1.5
United States	93	0.7	34	1.4	26	1.4	19	1.3	29	1.1
International average of 38 nations	80	0.2	43	0.3	24	0.3	40	0.4	33	0.3

[1]Designated LSS because only Latvian-speaking schools were tested which represents 61 percent of the population.
[2]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 appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines. See appendix 2 for details.
The international average is the average of the national percentages of the 38 nations.
s.e. means standard error.

SOURCE: Boston College, International Study Center, Third International Mathematics and Science Study–Repeat (TIMSS–R), unpublished tabulations, 1999; Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibits 2.3, 2.9, and 2.18. Chestnut Hill, MA: Boston College.

Table A3.7.—Percent correct on science assessment item examples with standard errors, by nation: 1999

Nation	Percentage of students responding correctly											
	Figure 11		Figure 12		Figure 13		Figure 14		Figure 15		Figure 16	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
Australia	53	2.0	44	2.4	48	2.8	72	1.7	66	2.5	30	2.2
Belgium-Flemish	53	1.6	45	2.2	51	3.5	70	1.6	53	2.7	23	1.5
Bulgaria	41	3.3	20	2.9	28	3.2	76	1.7	50	3.3	3	0.8
Canada	46	1.3	38	1.8	43	1.9	72	1.6	60	3.0	26	1.4
Chile	14	1.1	11	1.4	8	1.3	64	1.1	38	1.9	2	0.6
Chinese Taipei	61	1.4	55	2.2	44	2.1	91	0.7	76	1.7	24	1.3
Cyprus	21	1.3	13	2.1	27	2.3	62	1.6	31	2.4	6	0.8
Czech Republic	40	1.9	26	3.0	30	2.6	72	1.8	57	3.3	19	1.7
England	51	1.6	46	3.1	42	3.0	76	1.6	56	2.6	31	1.8
Finland	48	1.8	26	2.6	40	3.0	83	1.3	57	3.0	17	1.5
Hong Kong SAR	61	1.6	36	2.3	32	2.0	79	1.4	74	2.2	20	1.3
Hungary	44	1.8	28	2.4	38	2.5	81	1.3	70	2.8	11	1.0
Indonesia	18	0.9	19	1.8	20	2.1	47	1.5	27	2.0	5	0.7
Iran, Islamic Republic of	23	1.4	9	1.3	21	1.8	76	1.3	38	2.3	2	0.4
(Israel)	25	1.2	15	1.7	35	2.6	66	1.7	51	2.5	9	1.0
Italy	21	1.4	22	2.2	23	2.3	65	1.6	50	2.3	6	1.0
Japan	52	1.2	28	2.1	46	2.1	70	1.3	68	1.7	19	1.3
Jordan	19	1.1	12	1.4	19	1.9	78	1.2	32	2.1	5	0.8
Korea, Republic of	50	1.1	54	1.7	52	1.8	73	1.1	47	2.0	30	1.1
Latvia-LSS[1]	37	1.9	20	2.5	26	2.5	69	1.7	38	2.9	7	1.0
Lithuania[2]	38	1.7	14	2.0	38	2.8	74	1.6	51	2.9	6	1.1
Macedonia, Republic of	28	1.9	21	2.2	20	2.5	65	1.8	37	2.8	7	1.1
Malaysia	51	1.6	31	2.1	20	1.8	66	1.7	24	1.3	2	0.5
Moldova	32	1.6	8	1.4	19	2.0	47	1.9	42	2.8	4	0.6
Morocco	17	1.0	2	0.8	7	1.0	24	1.1	20	1.9	2	0.5
Netherlands	49	2.9	36	4.7	58	3.9	80	2.2	61	3.5	20	2.7
New Zealand	41	1.9	38	2.7	42	2.6	66	1.7	56	2.5	28	2.0
Philippines	16	0.9	17	2.1	4	0.9	48	1.6	33	1.8	2	0.5
Romania	26	1.9	19	2.4	22	2.8	71	1.7	48	2.8	3	0.7
Russian Federation	50	2.5	30	2.6	33	2.6	81	1.3	60	3.6	6	1.1
Singapore	44	2.4	72	2.5	49	3.2	81	1.8	69	2.2	32	2.6
Slovak Republic	43	2.2	21	2.5	50	2.9	73	1.5	45	2.9	8	1.1
Slovenia	59	2.1	23	2.1	33	3.0	70	1.6	57	3.1	8	1.1
South Africa	21	0.9	3	0.8	3	0.7	26	1.7	25	1.5	1	0.2
Thailand	26	1.3	14	1.5	28	2.2	70	1.2	49	2.4	4	0.7
Tunisia	16	0.9	13	1.3	19	1.9	44	1.3	21	1.6	2	0.5
Turkey	26	1.0	23	2.1	17	2.3	58	0.9	43	2.2	4	0.8
United States	48	1.6	35	2.1	30	1.9	66	1.4	62	1.8	21	1.3
International average of 38 nations	37	0.3	26	0.4	31	0.4	67	0.2	48	0.4	12	0.2

[1]Designated LSS because only Latvian-speaking schools were tested which represents 61 percent of the population.
[2]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 appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines. See appendix 2 for details.
The international average is the average of the national percentages of the 38 nations.
s.e. means standard error.
SOURCE: Boston College, International Study Center, Third International Mathematics and Science Study–Repeat (TIMSS–R), unpublished tabulations, 1999; Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibits 2.3, 2.13, and 2.18. Chestnut Hill, MA: Boston College.

Table A3.8.—U.S. eighth-grade mathematics and science achievement with standard errors, by selected characteristics: 1999

Mathematics		
Characteristics	Average	s.e.
Sex		
Boys	505	4.8
Girls	498	3.8
Race/ethnicity		
White students	525	4.6
Black students	444	5.3
Hispanic students	457	6.3
National origin of parents		
Both U.S. born	510	3.8
Both foreign born	477	8.7
1 U.S. born, 1 foreign born	496	6.4
Mother's education		
High school or less	484	3.5
Some vocational + some college	511	3.9
Completed college	539	5.4
Father's education		
High school or less	482	4.0
Some vocational + some college	512	4.3
Completed college	543	5.6
Public/nonpublic school		
Public school students	498	4.3
Nonpubic school students	526	7.4

Science		
Characteristics	Average	s.e.
Sex		
Boys	524	5.2
Girls	505	4.6
Race/ethnicity		
White students	547	4.0
Black students	438	5.7
Hispanic students	462	7.4
National origin of parents		
Both U.S. born	527	4.1
Both foreign born	472	8.0
1 U.S. born, 1 foreign born	509	7.0
Mother's education		
High school or less	499	6.1
Some vocational + some college	525	5.3
Completed college	554	4.9
Father's education		
High school or less	495	5.9
Some vocational + some college	529	6.7
Completed college	560	4.7
Public/nonpublic school		
Public school students	510	4.9
Nonpublic school students	548	7.1

NOTE: Other factors not controlled for in these analyses.
s.e. means standard error.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study–Repeat (TIMSS–R), unpublished tabulations, 1999.

Appendix 3—Supporting Data for Chapter 2

Table A3.9.—Average mathematics and science achievement of eighth-grade students with standard errors, by sex, by nation: 1999

Mathematics					Science				
Nation	Girls		Boys		Nation	Girls		Boys	
	Average	s.e.	Average	s.e.		Average	s.e.	Average	s.e.
Australia	524	5.7	526	5.7	Australia	532	5.1	549	6.0
Belgium-Flemish	560	7.2	556	8.3	Belgium-Flemish	526	4.7	544	7.2
Bulgaria	510	5.9	511	6.9	Bulgaria	511	5.8	525	6.5
Canada	529	2.5	533	3.2	Canada	526	3.2	540	2.4
Chile	388	4.3	397	5.8	Chile	409	4.3	432	5.1
Chinese Taipei	583	3.9	587	5.3	Chinese Taipei	561	3.9	578	5.7
Cyprus	479	2.1	474	2.7	Cyprus	455	3.1	465	3.0
Czech Republic	512	4.0	528	5.8	Czech Republic	523	4.8	557	4.9
England	487	5.4	505	5.0	England	522	6.2	554	5.3
Finland	519	3.0	522	3.5	Finland	530	4.0	540	4.5
Hong Kong SAR	583	4.7	581	5.9	Hong Kong SAR	522	4.4	537	5.1
Hungary	529	4.0	535	4.3	Hungary	540	4.0	565	4.5
Indonesia	401	5.4	405	5.0	Indonesia	427	6.5	444	4.8
Iran, Islamic Republic of	408	4.2	432	4.8	Iran, Islamic Republic of	430	5.7	461	4.4
(Israel)	459	4.2	474	4.8	(Israel)	461	6.0	476	5.5
Italy	475	4.5	484	4.3	Italy	484	4.1	503	5.6
Japan	575	2.4	582	2.3	Japan	543	2.8	556	3.6
Jordan	431	4.7	425	5.9	Jordan	460	5.0	442	5.9
Korea, Republic of	585	3.1	590	2.2	Korea, Republic of	538	4.0	559	3.2
Latvia-LSS[1]	502	3.8	508	4.4	Latvia-LSS[1]	495	5.6	510	4.8
Lithuania[2]	480	4.7	483	4.8	Lithuania[2]	478	4.4	499	5.0
Macedonia, Republic of	446	5.3	447	4.3	Macedonia, Republic of	458	6.0	458	5.4
Malaysia	521	4.7	517	6.0	Malaysia	488	5.5	498	5.8
Moldova	468	4.1	471	4.7	Moldova	454	4.4	465	5.4
Morocco	326	5.3	344	4.1	Morocco	312	5.9	330	5.9
Netherlands	538	7.6	542	7.0	Netherlands	536	7.1	554	7.3
New Zealand	495	5.5	487	7.6	New Zealand	506	5.4	513	7.0
Philippines	352	6.9	337	6.5	Philippines	351	8.2	339	8.9
Romania	475	6.3	470	6.2	Romania	468	6.4	475	6.5
Russian Federation	526	6.0	526	6.4	Russian Federation	519	7.1	540	6.2
Singapore	603	6.1	606	7.5	Singapore	557	7.9	578	9.7
Slovak Republic	532	4.2	536	4.5	Slovak Republic	525	3.4	546	4.5
Slovenia	529	3.0	531	3.6	Slovenia	527	3.7	540	3.7
South Africa	267	7.5	283	7.3	South Africa	234	9.2	253	7.7
Thailand	469	5.7	465	5.5	Thailand	481	4.6	484	4.4
Tunisia	436	2.4	460	2.9	Tunisia	417	3.3	442	4.3
Turkey	428	4.7	429	4.4	Turkey	431	4.8	434	4.3
United States	498	3.9	505	4.8	United States	505	4.6	524	5.5
International average of 38 nations	485	0.8	489	0.9	International average of 38 nations	480	0.9	495	0.9

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

[2]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 appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines. See appendix 2 for details.
The international average is the average of the national averages of the 38 nations.
s.e. means standard error.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 1.11. Chestnut Hill, MA: Boston College; Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 1.11. Chestnut Hill, MA: Boston College.

Table A3.10.—Comparisons of eighth-grade mathematics achievement with standard errors, by nation: 1995 and 1999

Nation	1995		1999		1995–1999 difference[3]	
	Average	s.e.	Average	s.e.	Average	s.e.
(Australia)	519	3.8	525	4.8	6	6.1
Belgium-Flemish	550	5.9	558	3.3	8	6.8
(Bulgaria)	527	5.8	511	5.9	-16	8.2
Canada	521	2.2	531	2.5	10	3.2
Cyprus	468	2.2	476	1.8	9	2.9
Czech Republic	546	4.5	520	4.2	-26	6.1
(England)	498	3.0	496	4.2	-1	5.2
Hong Kong SAR	569	6.1	582	4.3	13	7.5
Hungary	527	3.2	532	3.7	5	4.9
Iran, Islamic Republic of	418	3.9	422	3.4	4	5.2
Italy	491	3.4	485	4.8	-6	6.0
Japan	581	1.6	579	1.7	-2	2.2
Korea, Republic of	581	2.0	587	2.0	6	2.8
(Latvia-LSS)[1]	488	3.6	505	3.4	17	5.0
(Lithuania)[2]	472	4.1	482	4.3	10	6.1
(Netherlands)	529	6.1	540	7.1	11	9.5
New Zealand	501	4.7	491	5.2	-10	7.1
(Romania)	474	4.6	472	5.8	-1	7.4
Russian Federation	524	5.3	526	5.9	2	8.0
Singapore	609	4.0	604	6.3	-4	7.4
Slovak Republic	534	3.1	534	4.0	0	4.9
(Slovenia)	531	2.8	530	2.8	-1	3.9
United States	492	4.7	502	4.0	9	6.2
International average of 23 nations	519	0.9	521	0.9	2	1.3
Nations with unapproved sampling procedures at the classroom level in 1995						
(Israel)[4]	513	6.2	482	4.7	-32	7.8
(South Africa)[4]	278	9.2	275	6.8	-3	11.5
(Thailand)[4]	516	6.1	467	5.1	-49	7.9

[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.

[4]Israel, South Africa and Thailand experienced significant difficulties with meeting international guidelines in 1995. These nations' averages are not included in the international average.

NOTE: Eighth grade in most nations. See appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines in 1995, 1999, or both years. See appendix 2 for details regarding 1999 data. See NCES (1996) for detatils for 1995 data.
The international average is the average of the national averages of the 23 nations.
The 1995 scores are based on re-scaled data.
s.e. means standard error.

SOURCE: Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 1.3. Chestnut Hill, MA: Boston College.

Table A3.11.—Comparisons of eighth-grade science achievement with standard errors, by nation: 1995 and 1999

Nation	1995		1999		1995–1999 difference[3]	
	Average	s.e.	Average	s.e.	Average	s.e.
(Australia)	527	4.0	540	4.4	14	6.0
Belgium-Flemish	533	6.4	535	3.1	2	7.1
(Bulgaria)	545	5.2	518	5.4	-27	7.5
Canada	514	2.6	533	2.1	19	3.3
Cyprus	452	2.1	460	2.4	8	3.3
Czech Republic	555	4.5	539	4.2	-16	6.1
(England)	533	3.6	538	4.8	5	5.8
Hong Kong SAR	510	5.8	530	3.7	20	6.8
Hungary	537	3.1	552	3.7	16	4.9
Iran, Islamic Republic of	463	3.6	448	3.8	-15	5.2
Italy	497	3.6	498	4.8	1	5.9
Japan	554	1.8	550	2.2	-5	3.0
Korea, Republic of	546	2.0	549	2.6	3	3.4
(Latvia-LSS)[1]	476	3.3	503	4.8	27	5.9
(Lithuania)[2]	464	4.0	488	4.1	25	5.7
(Netherlands)	541	6.0	545	6.9	3	9.1
New Zealand	511	4.9	510	4.9	-1	6.9
(Romania)	471	5.1	472	5.8	1	7.8
Russian Federation	523	4.5	529	6.4	7	7.9
Singapore	580	5.5	568	8.0	-12	9.8
Slovak Republic	532	3.3	535	3.3	3	4.5
(Slovenia)	541	2.8	533	3.2	-8	4.4
United States	513	5.6	515	4.6	2	7.2
International average of 23 nations	518	0.9	521	0.9	3	1.3
Nations with unapproved sampling procedures at the classroom level in 1995						
(Israel)[4]	509	6.3	484	5.7	-25	8.3
(South Africa)[4]	263	11.1	243	7.9	-20	13.7
(Thailand)[4]	510	4.7	482	4.0	-28	6.2

[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.

[4]Israel, South Africa and Thailand experienced significant difficulties with meeting international guidelines in 1995. These nations' averages are not included in the international average.

NOTE: Eighth grade in most nations. See appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines in 1995, 1999, or both years. See appendix 2 for details regarding 1999 data. See NCES (1996) for detatils for 1995 data.
The international average is the average of the national averages of the 23 nations.
The 1995 scores are based on re-scaled data.
s.e. means standard error.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 1.3. Chestnut Hill, MA: Boston College.

Table A3.12.—Comparisons of percentages of eighth-grade students reaching the TIMSS–R 1999 top 10 percent international benchmark of mathematics achievement with standard errors: 1995 and 1999

Nation	1995 percentage of students		1999 percentage of students		1995–1999 difference[3]	
	Percent	s.e.	Percent	s.e.	Percent	s.e.
(Australia)	11	1.2	12	1.8	1	2.2
Belgium-Flemish	19	1.6	23	1.4	4	2.2
(Bulgaria)	19	2.0	11	2.3	-8	3.0
Canada	9	0.9	12	1.1	3	1.4
Cyprus	4	0.4	3	0.4	-1	0.6
Czech Republic	19	2.1	11	1.4	-8	2.5
(England)	8	1.2	7	0.9	0	1.6
Hong Kong SAR	28	2.6	33	2.3	5	3.4
Hungary	13	1.1	16	1.2	3	1.6
Iran, Islamic Republic of	0	0.3	1	0.2	0	0.4
Italy	7	0.8	6	1.0	-1	1.2
Japan	34	1.0	33	1.1	0	1.5
Korea, Republic of	36	1.2	37	1.0	2	1.4
(Lativa-LSS)[1]	5	0.8	7	0.9	3	1.2
(Lithuania)[2]	3	0.5	4	0.7	1	0.9
(Netherlands)	12	2.1	14	2.3	3	3.1
New Zealand	8	1.2	8	1.2	0	1.7
(Romania)	5	0.8	5	1.1	0	1.3
Russian Federation	12	1.4	15	1.8	2	2.2
Singapore	46	3.0	46	3.5	0	4.7
Slovak Republic	14	1.2	14	1.4	-1	1.8
(Slovenia)	13	1.1	15	1.2	2	1.5
United States	6	0.9	9	1.0	3	1.4
International average of 23 nations	14	0.4	15	0.3	1	0.4
Nations with unapproved sampling procedures at the classroom level in 1995						
(Israel)[4]	8	1.5	6	0.7	-3	1.6
(South Africa)[4]	0	0.2	0	0.2	0	0.3
(Thailand)[4]	10	2.1	4	0.8	-5	2.3

[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.

[4]Israel, South Africa and Thailand experienced significant difficulties with meeting international guidelines in 1995. These nations' averages are not included in the international average.

NOTE: Eighth grade in most nations. See appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines in 1995, 1999, or both years. See appendix 2 for details regarding 1999 data. See (NCES 1996) for details for 1995 data.
The international average is the average of the national averages of the 23 nations.
The 1995 scores are based on re-scaled data.
s.e. means standard error.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 1.7. Chestnut Hill, MA: Boston College.

Table A3.13.—Comparisons of percentages of eighth-grade students reaching the TIMSS–R 1999 top 10 percent international benchmark of science achievement with standard errors: 1995 and 1999

Nation	1995 percentage of students		1999 percentage of students		1995–1999 difference[3]	
	Percent	s.e.	Percent	s.e.	Percent	s.e.
(Australia)	17	1.3	19	1.6	3	2.0
Belgium-Flemish	12	1.2	11	1.4	-1	1.8
(Bulgaria)	24	1.8	14	2.1	-10	2.8
Canada	11	0.7	14	0.9	3	1.1
Cyprus	3	0.4	2	0.5	0	0.6
Czech Republic	21	2.2	17	1.7	-4	2.6
(England)	17	1.8	19	1.9	2	2.6
Hong Kong SAR	9	1.2	10	1.1	1	1.7
Hungary	14	1.2	22	1.4	8	1.9
Iran, Islamic Republic of	2	0.5	2	0.3	0	0.6
Italy	7	1.0	8	1.1	1	1.5
Japan	21	1.0	19	1.1	-2	1.6
Korea, Republic of	20	1.0	22	1.1	2	1.6
(Lativa-LSS)[1]	4	0.7	7	1.3	3	1.4
(Lithuania)[2]	3	0.7	6	0.9	3	1.1
(Netherlands)	15	2.0	16	2.3	1	3.0
New Zealand	11	1.3	12	1.4	0	1.9
(Romania)	6	0.9	6	0.8	0	1.2
Russian Federation	13	1.2	17	2.4	4	2.8
Singapore	33	3.2	32	3.3	-1	4.6
Slovak Republic	15	1.3	14	1.4	0	1.8
(Slovenia)	16	1.2	16	1.1	0	1.7
United States	13	1.2	15	1.2	2	1.7
International average of 23 nations	13	0.3	14	0.4	1	0.4
Nations with unapproved sampling procedures at the classroom level in 1995						
(Israel)[4]	12	1.8	8	0.8	-4	2.0
(South Africa)[4]	1	0.5	0	0.2	0	0.6
(Thailand)[4]	6	1.3	3	0.7	-2	1.5

[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.

[4]Israel, South Africa and Thailand experienced significant difficulties with meeting international guidelines in 1995. These nations' averages are not included in the international average.

NOTE: Eighth grade in most nations. See appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines in 1995, 1999, or both years. See appendix 2 for details regarding 1999 data. See NCES (1996) for details for 1995 data.
The international average is the average of the national averages of the 23 nations.
The 1995 scores are based on re-scaled data.
s.e. means standard error.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 1.7. Chestnut Hill, MA: Boston College.

Table A3.14.—Comparisons of percent correct in mathematics content areas with standard errors: 1995 and 1999

Nation	Percent correct in mathematics content areas											
	Total mathematics trend items (48 items)				Fractions and number sense trend items (17 items)				Measurement trend items (6 items)			
	1995		1999		1995		1999		1995		1999	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
(Australia)	68	0.9	69	1.1	68	0.8	70	1.0	71	0.9	73	1.1
Belgium-Flemish	73	1.3	76	1.2	75	1.2	77	0.8	77	1.5	79	1.7
(Bulgaria)	70	1.3	65	1.3	67	1.6	61	1.4	69	1.5	63	1.1
Canada	67	0.5	70	0.4	69	0.5	72	0.5	64	0.6	67	0.7
Cyprus	54	0.5	56	0.4	55	0.5	58	0.5	45	0.8	46	0.6
Czech Republic	72	1.0	67	0.9	67	1.2	61	1.1	80	0.8	77	1.0
(England)	64	0.6	63	0.9	65	0.7	65	0.9	67	0.8	66	1.2
Hong Kong SAR	77	1.3	79	0.9	78	1.3	81	0.9	76	1.4	77	1.0
Hungary	67	0.8	68	0.8	63	0.8	65	0.9	73	0.8	74	0.7
Iran, Islamic Republic of	44	0.6	44	0.6	46	0.7	45	0.7	31	1.0	34	0.7
Italy	60	0.9	58	1.1	57	1.0	55	1.1	64	1.2	63	1.2
Japan	78	0.3	78	0.3	76	0.4	76	0.4	75	0.4	74	0.5
Korea, Republic of	80	0.4	81	0.4	76	0.5	77	0.4	81	0.6	83	0.4
(Latvia-LSS)[1]	59	0.8	64	0.8	54	0.9	59	0.9	66	1.0	70	1.0
(Lithuania)[2]	56	1.0	57	1.0	52	1.0	54	1.1	57	0.9	56	0.9
(Netherlands)	70	1.6	74	1.6	70	1.3	75	1.7	76	1.6	77	1.6
New Zealand	64	1.1	62	1.2	65	1.0	63	1.2	66	1.2	65	1.3
(Romania)	55	1.0	54	1.1	51	0.9	50	1.1	57	1.2	57	1.3
Russian Federation	68	1.4	68	1.3	64	1.7	64	1.4	69	1.1	73	1.3
Singapore	84	0.7	83	1.1	87	0.6	85	1.0	86	0.7	83	1.1
Slovak Republic	69	0.7	69	0.9	66	0.8	67	1.1	75	0.7	75	0.9
(Slovenia)	69	0.7	70	0.6	68	0.8	69	0.7	72	0.8	72	0.7
United States	61	1.1	63	0.9	63	1.1	66	0.9	53	1.1	55	1.1
International average of 23 nations	65	0.2	65	0.2	64	0.2	64	0.2	66	0.2	66	0.2
Nations with unapproved sampling procedures at the classroom level in 1995												
(Israel)[3]	66	1.3	59	1.1	67	1.2	61	1.0	63	1.5	55	1.1
(South Africa)[3]	29	1.2	27	0.8	32	1.2	29	0.8	30	1.4	28	0.7
(Thailand)[3]	65	1.3	54	1.0	66	1.3	55	1.1	63	1.5	51	1.2

[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]Israel, South Africa and Thailand experienced significant difficulties with meeting international guidelines in 1995. These nations' averages are not included in the international average.

NOTE: Eighth grade in most nations. See appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines in 1995, 1999, or both years. See appendix 2 for details regarding 1999 data. See NCES (1996) for details for 1995 data.
The international average is the average of the national averages of the 23 nations.
The 1995 scores are based on re-scaled data.
s.e. means standard error.

SOURCE: Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 3.4. Chestnut Hill, MA: Boston College.

Table A3.14.—Comparisons of percent correct in mathematics content areas with standard errors: 1995 and 1999—Continued

Nation	Percent correct in mathematics content areas											
	Data represenation, analysis, and probability trend items (8 items)				Geometry trend items (6 items)				Algebra trend items (11 items)			
	1995		1999		1995		1999		1995		1999	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
(Australia)	71	0.8	74	1.0	58	1.1	59	1.4	67	1.0	69	1.2
Belgium-Flemish	74	1.3	77	1.3	66	1.4	69	1.9	72	1.6	73	1.3
(Bulgaria)	74	1.3	66	1.1	76	1.2	73	1.5	71	1.5	66	1.4
Canada	70	0.7	73	0.5	61	0.7	64	0.7	64	0.7	70	0.6
Cyprus	56	0.7	59	0.6	56	0.8	59	0.7	53	0.6	54	0.6
Czech Republic	75	0.8	73	0.8	73	1.2	67	1.2	72	1.3	65	1.1
(England)	71	0.7	73	0.9	51	1.0	49	1.2	61	0.8	60	1.2
Hong Kong SAR	74	1.1	78	0.8	78	1.6	80	1.1	78	1.4	79	1.0
Hungary	74	0.6	75	0.9	56	1.1	55	1.1	70	0.9	72	0.8
Iran, Islamic Republic of	45	0.7	47	0.6	44	0.9	44	0.8	48	0.9	47	0.8
Italy	67	0.9	65	1.3	59	1.2	58	1.3	58	1.0	55	1.3
Japan	79	0.3	80	0.4	84	0.4	82	0.5	79	0.4	79	0.5
Korea, Republic of	85	0.5	85	0.3	83	0.6	84	0.5	81	0.4	83	0.5
(Latvia-LSS)[1]	63	0.9	69	0.8	67	1.0	73	0.9	56	1.0	60	0.9
(Lithuania)[2]	61	1.0	66	0.9	64	1.3	63	1.4	55	1.2	54	1.2
(Netherlands)	77	1.6	80	1.5	62	1.8	66	1.7	65	2.1	70	2.0
New Zealand	70	1.0	69	1.3	55	1.3	51	1.4	60	1.2	60	1.5
(Romania)	57	1.1	56	1.1	62	1.3	59	1.3	56	1.2	55	1.3
Russian Federation	69	1.4	69	1.2	71	1.0	70	1.6	69	1.5	71	1.4
Singapore	79	0.8	79	1.1	82	0.9	81	1.3	83	0.9	82	1.3
Slovak Republic	71	0.8	73	0.9	71	0.9	71	1.2	67	1.0	66	1.1
(Slovenia)	75	0.7	76	0.7	64	0.9	63	0.9	69	0.8	69	0.7
United States	67	1.0	69	0.9	50	1.1	52	1.0	63	1.3	66	1.0
International average of 23 nations	68	0.2	69	0.2	63	0.2	63	0.2	64	0.2	65	0.2
Nations with unapproved sampling procedures at the classroom level in 1995												
(Israel)[3]	66	1.5	62	1.1	65	1.6	56	1.3	65	1.6	59	1.2
(South Africa)[3]	31	1.1	29	0.8	23	1.2	22	0.7	27	1.4	26	1.0
(Thailand)[3]	66	1.0	58	1.0	68	1.4	57	1.3	64	1.5	50	1.1

[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]Israel, South Africa and Thailand experienced significant difficulties with meeting international guidelines in 1995. These nations' averages are not included in the international average.

NOTE: Eighth grade in most nations. See appendix 2 for details.

Parentheses indicate nations not meeting international sampling and/or other guidelines in 1995, 1999, or both years. See appendix 2 for details regarding 1999 data. See NCES (1996) for details for 1995 data.

The international average is the average of the national averages of the 23 nations.

The 1995 scores are based on re-scaled data.

s.e. means standard error.

SOURCE: Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 3.4. Chestnut Hill, MA: Boston College.

Table A3.15.—Comparisons of percent correct in science content areas with standard errors: 1995 and 1999

Nation	Percent correct in science content areas											
	Total science trend items (48 items)				Earth science trend items (11 items)				Life science items (13 items)			
	1995		1999		1995		1999		1995		1999	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
(Australia)	68	0.6	69	0.7	64	0.7	64	0.9	75	0.6	76	0.7
Belgium-Flemish	69	0.8	69	0.5	68	0.8	67	0.7	76	1.0	77	0.7
(Bulgaria)	74	0.9	72	0.8	70	1.1	68	1.0	82	0.8	80	0.8
Canada	65	0.4	68	0.3	61	0.6	64	0.5	72	0.5	75	0.4
Cyprus	56	0.4	57	0.3	53	0.5	53	0.4	67	0.6	67	0.5
Czech Republic	74	0.7	72	0.6	73	0.9	69	0.8	84	0.7	83	0.6
(England)	68	0.5	70	0.6	63	0.7	65	0.7	75	0.6	77	0.7
Hong Kong SAR	66	0.8	69	0.5	60	0.8	63	0.5	77	0.9	79	0.6
Hungary	73	0.5	76	0.5	74	0.7	76	0.7	81	0.6	82	0.5
Iran, Islamic Republic of	59	0.5	57	0.7	57	0.6	55	0.7	62	0.6	60	0.6
Italy	65	0.7	64	0.8	62	0.9	62	1.0	72	0.8	72	0.8
Japan	71	0.3	72	0.3	65	0.4	68	0.4	77	0.4	78	0.4
Korea, Republic of	71	0.4	72	0.3	70	0.5	71	0.4	76	0.5	76	0.4
(Latvia-LSS)[1]	63	0.5	65	0.5	61	0.8	64	0.8	71	0.7	75	0.6
(Lithuania)[2]	62	0.7	65	0.7	58	0.9	60	0.8	68	0.8	71	0.7
(Netherlands)	71	1.0	71	1.1	65	1.4	68	1.3	81	1.0	81	1.3
New Zealand	64	0.7	63	0.7	59	0.8	59	0.8	70	0.9	70	0.9
(Romania)	62	0.9	62	0.8	61	1.0	60	1.0	69	1.0	68	0.8
Russian Federation	69	0.8	72	1.1	65	0.7	67	1.2	75	0.8	77	1.1
Singapore	74	0.9	71	1.2	64	1.0	61	1.0	80	0.9	78	1.3
Slovak Republic	70	0.6	71	0.6	67	0.8	67	0.8	76	0.6	84	0.6
(Slovenia)	72	0.5	70	0.5	76	0.6	73	0.6	76	0.5	76	0.6
United States	66	0.7	67	0.6	62	0.8	62	0.7	75	0.8	76	0.8
International average of 23 nations	66	0.1	67	0.1	63	0.2	63	0.2	73	0.2	74	0.2
Nations with unapproved sampling procedures at the classroom level in 1995												
(Israel)[3]	67	0.9	63	0.8	61	1.0	57	0.9	74	1.1	68	0.9
(South Africa)[3]	37	1.1	35	0.7	34	1.0	34	0.5	38	1.4	37	0.9
(Thailand)[3]	65	0.8	58	0.8	63	0.9	52	0.9	79	0.7	72	0.8

[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]Israel, South Africa and Thailand experienced significant difficulties with meeting international guidelines in 1995. These nations' averages are not included in the international average.

NOTE: Eighth grade in most nations. See appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines in 1995, 1999, or both years. See appendix 2 for details regarding 1999 data. See NCES (1996) for details for 1995 data.
The international average is the average of the national averages of the 23 nations.
The 1995 scores are based on re-scaled data.
s.e. means standard error.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 3.4. Chestnut Hill, MA: Boston College.

Table A3.15.—Comparisons of percent correct in science content areas with standard errors: 1995 and 1999—Continued

Nation	Percent correct in science content areas							
	Physics trend items (15 items)				Chemistry trend items (5 items)			
	1995		1999		1995		1999	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
(Australia)	62	0.6	64	0.7	71	0.9	72	1.0
Belgium-Flemish	64	0.9	63	0.5	72	0.8	70	0.8
(Bulgaria)	69	1.1	67	0.9	80	1.4	76	1.1
Canada	61	0.5	64	0.4	71	0.6	74	0.6
Cyprus	50	0.4	53	0.4	62	0.7	61	0.6
Czech Republic	68	0.6	65	0.7	72	1.0	70	0.9
(England)	65	0.6	65	0.7	72	1.0	73	0.9
Hong Kong SAR	62	0.8	64	0.5	68	1.3	72	0.9
Hungary	63	0.5	69	0.6	78	0.8	83	0.6
Iran, Islamic Republic of	56	0.7	54	0.8	66	0.7	64	0.9
Italy	59	0.7	58	0.9	68	1.1	66	1.2
Japan	69	0.3	69	0.3	74	0.6	74	0.6
Korea, Republic of	68	0.4	69	0.4	72	0.7	73	0.5
(Latvia-LSS)[1]	56	0.6	57	0.6	62	0.8	68	0.8
(Lithuania)[2]	58	0.7	61	0.7	68	1.0	70	1.2
(Netherlands)	66	0.8	66	1.0	72	1.2	73	1.2
New Zealand	59	0.6	58	0.6	70	1.1	68	1.0
(Romania)	57	1.0	57	0.9	65	1.1	65	1.2
Russian Federation	66	1.1	68	1.3	74	1.4	77	1.3
Singapore	74	0.8	72	1.0	81	1.1	76	1.6
Slovak Republic	65	0.7	62	0.7	77	0.8	74	1.0
(Slovenia)	65	0.6	63	0.5	72	1.0	71	0.8
United States	61	0.6	62	0.6	72	1.2	72	1.0
International average of 23 nations	62	0.1	62	0.1	70	0.2	70	0.2
Nations with unapproved sampling procedures at the classroom level in 1995								
(Israel)[3]	62	0.9	62	0.7	73	1.3	69	1.2
(South Africa)[3]	37	1.2	34	0.7	38	1.3	35	1.0
(Thailand)[3]	59	0.9	53	0.8	50	1.1	45	1.0

[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]Israel, South Africa and Thailand experienced significant difficulties with meeting international guidelines in 1995. These nations' averages are not included in the international average.

NOTE: Eighth grade in most nations. See appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines in 1995, 1999, or both years. See appendix 2 for details regarding 1999 data. See NCES (1996) for details for 1995 data.
The international average is the average of the national averages of the 23 nations.
The 1995 scores are based on re-scaled data.
s.e. means standard error.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 3.4. Chestnut Hill, MA: Boston College.

Table A3.16.—U.S. mathematics and science achievement with standard errors, by selected characteristics: 1995 and 1999

MATHEMATICS					
1995			1999		
Characteristics	Average	s.e.	Characteristics	Average	s.e.
Sex			**Sex**		
Boys	495	5.5	Boys	505	4.8
Girls	490	4.7	Girls	498	3.9
Race/ethnicity			**Race/ethnicity**		
White students	516	3.5	White students	525	4.6
Black students	419	6.8	Black students	444	5.3
Hispanic students	443	3.8	Hispanic students	457	6.3
National origin of parents			**National origin of parents**		
Both U.S. born	496	4.5	Both U.S. born	510	3.8
Both foreign born	474	8.5	Both foreign born	477	8.7
1 U.S. born, 1 foreign born	482	11.1	1 U.S. born, 1 foreign born	496	6.4
Mother's education			**Mother's education**		
High school or less	479	4.2	High school or less	484	3.5
Some vocational+some college	498	5.2	Some vocational+some college	511	3.9
Completed college	511	6.3	Completed college	539	5.4
Father's education			**Father's education**		
High school or less	474	4.4	High school or less	482	4.0
Some vocational+some college	498	4.7	Some vocational+some college	512	4.2
Completed college	515	5.7	Completed college	543	5.6

SCIENCE					
Sex			**Sex**		
Boys	520	5.9	Boys	524	5.5
Girls	505	5.5	Girls	505	4.6
Race/ethnicity			**Race/ethnicity**		
White students	544	3.3	White students	547	4.0
Black students	422	8.3	Black students	438	5.7
Hispanic students	446	5.0	Hispanic students	462	7.4
National origin of parents			**National origin of parents**		
Both U.S. born	521	4.9	Both U.S. born	527	4.1
Both foreign born	465	8.9	Both foreign born	472	8.0
1 U.S. born, 1 foreign born	498	11.5	1 U.S. born, 1 foreign born	509	7.0
Mother's education			**Mother's education**		
High school or less	497	4.8	High school or less	499	6.1
Some vocational+some college	522	6.2	Some vocational+some college	525	5.3
Completed college	531	6.5	Completed college	554	4.9
Father's education			**Father's education**		
High school or less	494	5.0	High school or less	495	5.9
Some vocational+some college	521	5.4	Some vocational+some college	529	6.7
Completed college	534	6.0	Completed college	560	4.7

NOTE: Other factors not controlled for in these analyses.
s.e. means standard error.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study–Repeat (TIMSS-R), unpublished tabulations, 1999.

Table A3.17.—Mathematics achievement of TIMSS-R 1999 nations that participated in 1995 at both the fourth and eighth grades relative to the average across these nations with standard errors

1995		
Fourth grade		
Nation	Difference[2]	s.e.
(Australia)	0	3.0
Canada	-12	3.3
Cyprus	-42	3.1
Czech Republic	23	3.1
(England)	-33	3.3
Hong Kong SAR	40	3.8
(Hungary)	4	3.5
Iran, Islamic Republic of	-130	4.8
(Italy)	-7	4.5
Japan	50	2.0
Korea, Republic of	63	1.9
(Latvia-LSS)[1]	-18	4.4
(Netherlands)	32	2.9
New Zealand	-48	4.2
Singapore	73	4.3
(Slovenia)	8	3.1
United States	0	2.9
International average of 17 nations	517	0.9

1999		
Eighth grade		
Nation	Difference[2]	s.e.
Australia	1	4.7
Canada	7	2.7
Cyprus	-48	1.9
Czech Republic	-4	4.1
England	-28	4.0
Hong Kong SAR	58	4.2
Hungary	8	3.6
Iran, Islamic Republic of	-102	3.3
Italy	-39	4.6
Japan	55	1.8
Korea, Republic of	63	2.0
Latvia-LSS[1]	-19	3.3
Netherlands	16	6.8
New Zealand	-33	4.9
Singapore	80	5.9
Slovenia	6	2.8
United States	-22	3.8
International average of 17 nations	524	1.0

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

[2]The difference between the national average and the international average for each of the 17 nations.

NOTE: Fourth and eighth grade in most nations. See appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines at fourth grade in 1995. See NCES (1997c) for details.
The international average is the average of the national averages of the 17 nations.
s.e. means standard error.

SOURCE: Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 1.4. Chestnut Hill, MA: Boston College.

Table A3.18.—Science achievement of TIMSS-R 1999 nations that participated in 1995 at both the fourth and eighth grades relative to the average across these nations with standard errors

1995 Fourth grade		
Nation	Difference[2]	s.e.
(Australia)	28	3.5
Canada	12	3.0
Cyprus	-64	3.1
Czech Republic	18	3.0
(England)	14	3.1
Hong Kong SAR	-6	3.3
(Hungary)	-6	3.3
Iran, Islamic Republic of	-134	4.4
(Italy)	10	4.4
Japan	39	1.9
Korea, Republic of	62	2.2
(Latvia-LSS)[1]	-27	4.7
(Netherlands)	17	3.1
New Zealand	-9	5.1
Singapore	10	4.6
(Slovenia)	8	3.9
United States	28	3.2
International average of 17 nations	514	0.9

1999 Eighth grade		
Nation	Difference[2]	s.e.
Australia	16	4.3
Canada	9	2.1
Cyprus	-64	2.3
Czech Republic	15	4.1
England	14	4.5
Hong Kong SAR	5	3.5
Hungary	28	3.6
Iran, Islamic Republic of	-76	3.7
Italy	-26	4.5
Japan	25	2.4
Korea, Republic of	24	2.6
Latvia-LSS[1]	-21	4.9
Netherlands	21	6.5
New Zealand	-15	4.8
Singapore	44	7.6
Slovenia	9	3.3
United States	-9	4.5
International average of 17 nations	524	1.1

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

[2]The difference between the national average and the international average for each of the 17 nations.

NOTE: Fourth and eighth grade in most nations. See appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines at fourth grade in 1995. See NCES (1997c) for details.
The international average is the average of the national averages of the 17 nations.
s.e. means standard error.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 1.4. Chestnut Hill, MA: Boston College.

Appendix 4

Supporting Data for Chapter 3

Appendix 4—Supporting Data for Chapter 3

Table A4.1.—Organization of science instruction at grade 8, by nation: 1999

Nations teaching science as a single general/integrated subject	Nations teaching science as separate subjects
Australia	Belgium-Flemish
Canada	Bulgaria
Chile	Chinese Taipei [1]
Cyprus	Czech Republic
England	Finland
Hong Kong SAR	Hungary
Iran, Islamic Republic of	Indonesia[2]
Israel	Latvia
Italy	Lithuania[3]
Japan	Macedonia, Republic of
Jordan	Moldova
Korea, Republic of	Morocco
Malaysia	Netherlands
New Zealand	Romania
Philippines	Russian Federation
Singapore	Slovak Republic
South Africa	Slovenia
Thailand	
Tunisia	
Turkey	
United States	

[1]In Chinese Taipei, separate sciences are taught starting in grade 7, with biology in grade 7 and physics/chemistry in grade 8. Students were administered the general version of the questionnaire and asked about "natural science." Science analyses based on teacher background data treat Chinese Taipei as teaching separate science subjects; science analyses based on student background data treat Chinese Taipei as teaching general/integrated science.

[2]In Indonesia, students are taught "IPA science" by separate biology and physics teachers, but students receive a single composite grade. Students were administered the general version of the questionnaire and asked about "IPA science." Science analyses based on teacher background data treat Indonesia as teaching separate science subjects; science analyses based on student background data treat Indonesia as teaching general/integrated science.

[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 appendix 2 for details.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 5. Chestnut Hill, MA: Boston College.

Table A4.2.—Eighth-grade mathematics teachers' reports of their main area of study with standard errors: 1999

Area of study	Percentage of students whose mathematics teachers reported a major area of study			
	U.S. average		International average*	
	Percent	s.e.	Percent	s.e.
Mathematics	41	3.4	71	0.6
Mathematics education	37	3.4	31	0.6
Science/science education	16	2.4	35	0.6
Education	54	3.4	32	0.6
Other	46	3.6	32	0.6

*The item response rate for this question was less than 70 percent in some nations. See Mullis et al. (2000) for details.

NOTE: Eighth grade in most nations. See appendix 2 for details.
Science includes biology, physics, chemistry, and science education.
Based on mathematics teachers' reports of major or main area of study for bachelor's and/or master's degree; more than one category could be selected.
The international average is the average of the national averages of the nations that reported data.
s.e. means standard error.

SOURCE: Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit R3.1. Chestnut Hill, MA: Boston College.

Table A4.3.—Eighth-grade science teachers' reports of their main area of study with standard errors: 1999

Area of study	Percentage of students whose science teachers reported a major area of study			
	U.S. average		International average*	
	Percent	s.e.	Percent	s.e.
Biology	47	3.5	42	0.8
Physics	13	2.2	23	0.7
Chemistry	21	3.0	30	0.8
Science education	43	3.7	44	0.9
Mathematics/mathematics education	14	2.5	25	0.7
Education	56	3.6	30	0.7
Other	45	3.7	29	0.8

*The item response rate for this question was less than 70 percent in some nations. See Martin et al. (2000) for details.

NOTE: Eighth grade in most nations. See appendix 2 for details.
Based on science teachers' reports of major or main area of study for bachelor's and/or master's degree; more than one category could be selected.
The international average is the average of the national averages of the nations that reported data.
s.e. means standard error.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit R3.1. Chestnut Hill, MA: Boston College.

Table A4.4.—Teachers' beliefs about their preparation to teach mathematics and science with standard errors: 1999

Percentage of 8th-grade students whose mathematics teachers reported feeling very well prepared to teach mathematics		
Nation	Percent	s.e.
Australia	84	2.7
Belgium-Flemish	80	1.4
Bulgaria	66	4.8
Canada	79	1.7
Chile	44	2.8
Chinese Taipei	78	2.6
Cyprus	89	0.9
Czech Republic	88	1.8
England	—	—
Finland	81	1.9
Hong Kong SAR	72	2.6
Hungary	59	3.3
Indonesia	81	2.1
Iran, Islamic Republic of	81	1.8
(Israel)	84	1.6
Italy	69	2.3
Japan	23	2.6
Jordan	88	1.7
Korea, Republic of	61	2.5
Lativa-LSS*	73	2.1
Lithuania	—	—
Macedonia, Republic of	92	1.0
Malaysia	81	2.5
Moldova	64	3.2
Morocco	75	1.3
Netherlands	84	5.3
New Zealand	88	1.9
Philippines	64	2.3
Romania	85	1.3
Russian Federation	—	—
Singapore	78	2.7
Slovak Republic	89	1.5
Slovenia	50	2.9
South Africa	71	1.9
Thailand	32	3.0
Tunisia	51	2.6
Turkey	83	1.6
United States	90	1.2
International average of 35 nations	73	0.4

Percentage of 8th-grade students whose science teachers reported feeling very well prepared to teach science		
Nation	Percent	s.e.
Australia	55	1.8
Belgium-Flemish	47	2.1
Bulgaria	46	1.9
Canada	44	1.7
Chile	29	1.9
Chinese Taipei	42	2.6
Cyprus	57	1.4
Czech Republic	64	2.0
England	—	—
Finland	47	1.7
Hong Kong SAR	34	2.4
Hungary	29	1.4
Indonesia	58	2.7
Iran, Islamic Republic of	42	2.8
(Israel)	55	1.7
Italy	42	2.1
Japan	17	1.7
Jordan	57	2.6
Korea, Republic of	31	1.9
Lativa-LSS*	37	1.5
Lithuania	—	—
Macedonia, Republic of	72	1.3
Malaysia	22	2.3
Moldova	39	1.6
Morocco	57	1.4
Netherlands	50	1.7
New Zealand	59	2.1
Philippines	41	2.3
Romania	57	1.5
Russian Federation	—	—
Singapore	46	2.4
Slovak Republic	—	—
Slovenia	—	—
South Africa	53	2.8
Thailand	30	2.4
Tunisia	32	1.9
Turkey	63	2.2
United States	58	1.5
International average of 33 nations	46	0.4

*Designated LSS because only Latvian-speaking schools were tested which represents 61 percent of the population.
— Data not available.

NOTE: Eighth grade in most nations. See appendix 2 for details.
Parentheses indicate nations not meeting international sampling and/or other guidelines. See appendix 2 for details.
The international average is the average of the national averages of the nations that reported data.
s.e. means standard error.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit R3.2. Chestnut Hill, MA: Boston College; Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit R3.2. Chestnut Hill, MA: Boston College.

Table A4.5.—Percentage of U.S. eighth-grade students taught by teachers that participated in professional development activities that emphasized different topics with standard errors: 1999

Professional Development Topic	Percentage of U.S. 8th-grade students taught by teachers who said their professional development activities emphasized the topic "quite a lot" or "a great deal"			
	Mathematics		Science	
	Percent	s.e.	Percent	s.e.
Curriculum	64	3.2	59	3.7
Subject-specific teaching methods in mathematics or science	40	3.9	40	3.5
General teaching methods	38	3.4	44	3.9
Approaches to assessment	33	3.1	37	3.9
Use of technology in instruction	44	3.7	46	2.6
Strategies for teaching diverse student populations	21	3.0	23	2.5
Information on how students learn mathematics or science	21	2.8	23	4.3
Deepening teacher's knowledge of mathematics or science	28	3.4	50	2.4
Leadership development	16	2.6	19	2.4

NOTE: s.e. means standard error.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study–Repeat (TIMSS–R), unpublished tabulations, 1999.

Table A4.6.—Percentage of eighth-grade students "taught" mathematics content areas with standard errors: 1999

	Fractions and number sense		Measurement		Data representation, analysis, and probability		Geometry		Algebra	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
United States	99	0.7	91	1.6	92	1.7	65	2.9	98	0.9
International average	95	0.3	86	0.5	59	0.7	58	0.7	88	0.5

NOTE: "Taught" equals the sum of percentages of students whose mathematics teachers reported these topics as either "taught before this year" or "taught more than five periods this year."
Eighth grade in most nations. See appendix 2 for details.
The international average is the average of the national averages of the nations that reported data.
s.e. means standard error.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study–Repeat (TIMSS–R), unpublished tabulations, 1999.

Table A4.7.—Percentage of eighth-grade students "taught" science content areas with standard errors: 1999

	Earth science		Biology		Physics		Chemistry		Environmental and resource issues		Scientific inquiry and the nature of science	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
United States	78	3.1	81	3.2	70	3.6	73	3.6	78	2.6	95	1.7
International average	57	0.7	60	0.7	53	0.7	67	0.6	72	0.6	80	0.6

NOTE: "Taught" equals the sum of percentages of students whose science teachers reported these topics as either "taught before this year" or "taught more than five periods this year."
Eighth grade in most nations. See appendix 2 for details.
The international average is the average of the national averages of the nations that reported data.
s.e. means standard error.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study–Repeat (TIMSS–R), unpublished tabulations, 1999.

Appendix 4—Supporting Data for Chapter 3

Table A4.8.—Eighth-grade students' reports of the occurrence of selected activities in their mathematics class "almost always" or "pretty often" with standard errors: 1999

	Teacher shows how to do a mathematics problem		Students work on worksheets or from textbooks		Students work on mathematics projects	
	Percent	s.e.	Percent	s.e.	Percent	s.e.
United States	94	0.6	86	0.7	29	1.3
International average	86	0.2	59	0.2	36	0.2

NOTE: Eighth grade in most nations. See appendix 2 for details.
The international average is the average of the national averages of the nations that reported data.
s.e. means standard error.
SOURCE: Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 6.11. Chestnut Hill, MA: Boston College.

Table A4.9.—Eighth-grade students' reports of the occurrence of selected activities in their science class "almost always" or "pretty often" with standard errors: 1999

	Teacher show how to do a science problem		Students work on worksheets or from textbooks		Students work on science projects		Teacher demonstrates a science experiment		Students conduct experiments	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
United States	69	1.4	76	1.5	59	1.3	71	1.1	65	1.5
International average of 23 nations	80	0.2	56	0.3	51	0.3	71	0.3	57	0.3

NOTE: Eighth grade in most nations. See appendix 2 for details.
The international average is the average of the national averages of the 23 nations that reported teaching a general/integrated science curriculum in 1999.
s.e. means standard error.
SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibits 6.10, R3.11, and R3.13. Chestnut Hill, MA: Boston College.

Table A4.10.—Eighth-grade students' reports of access to computers and the Internet with standard errors: 1999

	Have computer at home		Have Internet access at home		Have Internet access at school		Have Internet access elsewhere	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
United States	80	1.2	59	1.7	76	3.2	81	0.9
International average	45	0.2	18	0.2	25	0.3	43	0.2

NOTE: Eighth grade in most nations. See appendix 2 for details.
The interational average is the average of the national averages of the nations that reported data.
s.e. means standard error.
SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibits R1.1 and 6.17. Chestnut Hill, MA: Boston College.

Table A4.11.—Eighth-grade students' reports of using computers in mathematics and science classes "almost always" or "pretty often" with standard errors: 1999

	Mathematics		Science	
	Percent	s.e.	Percent	s.e.
United States	12	1.1	21	1.4
International average	5	0.1	8	0.2

NOTE: Eighth grade in most nations. See appendix 2 for details.
The interational average is the average of the national averages of the nations that reported data.
s.e. means standard error.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 6.15. Chestnut Hill, MA: Boston College; Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 6.18. Chestnut Hill, MA: Boston College.

Table A4.12.—Eighth-grade students' reports of discussing or beginning homework in mathematics and science classes "almost always" or "pretty often" with standard errors: 1999

	Discuss completed homework in mathematics class		Begin homework in mathematics class		Discuss completed homework in science class		Begin homework in science class	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
United States	79	1.2	74	1.6	63	1.9	57	2.0
International average	55	0.2	42	0.2	51	0.3	41	0.3

NOTE: Eighth grade in most nations. See appendix 2 for details.
The international average is the average of the national averages of the nations that reported data.
s.e. means standard error.

SOURCE: Martin et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 6.10. Chestnut Hill, MA: Boston College; Mullis et al. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade.* Exhibit 6.11. Chestnut Hill, MA: Boston College.

Appendix 5

Comparisons of all TIMSS and TIMSS-R Nations

Appendix 5—Comparisons of all TIMSS and TIMSS-R Nations

How does the United States perform in comparison to all TIMSS and TIMSS–R nations?

Variation in the number of nations in international studies conducted to date can make interpretation of international averages and comparisons of performance of the United States to other nations difficult. This is particularly true when attempts are made to look at changes in the relative performance of the United States over the years. However, TIMSS–R was specifically designed to allow for a direct comparison of mathematics and science achievement of eighth-graders over 4 years' time. The establishment of a common scale for the eighth grade components of TIMSS and TIMSS–R allows us to develop the best set of international comparisons, and the best estimate of the relative international performance of the United States to date. TIMSS included 42 nations. TIMSS–R included 38 nations, of which 26 are in common between TIMSS and TIMSS–R. Combining the scores of nations from TIMSS and TIMSS–R allows us to use a comparison group of 54 nations for this purpose. Not only does this increase the overall number of nations with which the United States is compared, but this extended list will also go some way toward overcoming criticisms that the comparison group of nations in the past has been biased toward developed nations with a heavy European participation.

Any attempt to combine the results from TIMSS and TIMSS–R raises the question of which national average to use for the 26 nations that participated in both TIMSS and TIMSS–R. From one point of view, it may be best to use the 1995 scores from these nations even though they have a 1999 score. In this case we would be comparing nations on the basis of their first participation in a TIMSS-like assessment. On the other hand, it may be most appropriate to use the most recent data available and so use the 1999 scores for the 26 nations in both studies. As it turns out, the results are quite similar, so for the purposes of this presentation we will use the most recent data (1999) for those nations that participated in TIMSS–R.

When looking at the data available for the 54 nations that participated in either TIMSS, TIMSS–R, or both, at the eighth grade, the United States performed above the international average of the 54 nations in mathematics. Seventeen nations outperformed the United States, 22 nations performed lower than the United States, and 14 nations performed similarly to the United States.

In science, the United States also performed above the international average of the 54 nations. Fourteen nations outperformed the United States, 26 nations performed lower than the United States, and 13 nations performed similarly to the United States

The findings from this combined TIMSS/TIMSS–R comparison are shown in table A5.1.

Relative to other nations in mathematics and science, the United States appears to have done better in science than in mathematics, if 'better' is defined as fewer nations outperforming the United States in one subject or the other. That is, when looking at the achievement of all 54 nations that participated in TIMSS or TIMSS–R, 14 nations outperformed the United States in eighth grade science whereas 17 nations outperformed the United States in eighth grade mathematics. These comparisons reflect the achievement of U.S. eighth-graders against the achievement of their peers in 53 other nations, the broadest spectrum of nations to date.

Table A5.1.—Mathematics and science acheivement of TIMSS-R and TIMSS nations with standard errors: 1995 and 1999

Mathematics		
Nation	Average	s.e.
Singapore	604	6.3
Korea, Republic of	587	2.0
Chinese Taipei	585	4.0
Hong Kong SAR	582	4.3
Japan	579	1.7
Belgium-Flemish	558	3.3
(Netherlands)	540	7.1
Slovak Republic	534	4.0
Switzerland*	534	2.7
Hungary	532	3.7
Canada	531	2.5
(Slovenia)	530	2.8
France*	530	2.8
(Austria)*	529	3.1
Russian Federation	526	5.9
(Australia)	525	4.8
Finland[1]	520	2.7
Czech Republic	520	4.2
Malaysia	519	4.4
Ireland*	519	4.8
(Belgium-French)*	518	3.8
Sweden*	513	2.7
(Bulgaria)	511	5.9
(Latvia-LSS)[2]	505	3.4
(Germany)*	502	4.5
United States	502	4.0
Norway*	499	2.2
(Denmark)*	497	3.1
(England)	496	4.2
(Scotland)*	493	5.7
New Zealand	491	5.2
Iceland*	484	4.9
Spain*	483	2.3
(Lithuania)[3]	482	4.3
Italy	479	3.8
(Greece)*	479	3.4
Cyprus	476	1.8
(Romania)	472	5.8
Moldova	469	3.9
(Thailand)	467	5.1
(Israel)	466	3.9
Portugal*	451	3.0
Tunisia	448	2.4
Macedonia, Republic of	447	4.2
Turkey	429	4.3
Jordan	428	3.6
Iran, Islamic Republic of	422	3.4
Indonesia	403	4.9
Chile	392	4.4
(Colombia)*	360	6.4
(Kuwait)*	355	5.8
Philippines	345	6.0
Morocco	337	2.6
(South Africa)	275	6.8
International average of 54 nations	486	0.6

Science		
Nation	Average	s.e.
Chinese Taipei	569	4.4
Singapore	568	8.0
Hungary	552	3.7
Japan	550	2.2
Korea, Republic of	549	2.6
(Netherlands)	545	6.9
(Australia)	540	4.4
Czech Republic	539	4.2
(Austria)*	539	3.8
(England)	538	4.8
Finland	535	3.5
Slovak Republic	535	3.3
Belgium-Flemish	535	3.1
(Slovenia)	533	3.2
Canada[1]	533	2.1
Hong Kong SAR	530	3.7
Russian Federation	529	6.4
Sweden*	523	2.9
Ireland*	518	5.1
(Bulgaria)	518	5.4
(Germany)*	518	5.5
United States	515	4.6
Norway*	514	2.4
New Zealand	510	4.9
Switzerland*	509	2.8
Spain*	504	2.3
(Latvia-LSS)[2]	503	4.8
(Scotland)*	501	5.6
Italy	493	3.9
Malaysia	492	4.4
(Lithuania)[3]	488	4.1
France*	488	3.2
(Greece)*	486	2.8
Iceland*	484	5.8
(Thailand)	482	4.0
Portugal*	473	3.1
(Romania)	472	5.8
(Denmark)*	472	3.8
(Israel)	468	4.9
(Belgium-French)*	466	3.8
Cyprus	460	2.4
Moldova	459	4.0
Macedonia, Republic of	458	5.2
Jordan	450	3.8
Iran, Islamic Republic of	448	3.8
Indonesia	435	4.5
Turkey	433	4.3
Tunisia	430	3.4
Chile	420	3.7
(Kuwait)*	415	5.6
(Colombia)*	393	6.9
Philippines	345	7.5
Morocco	323	4.3
(South Africa)	243	7.9
International average of 54 nations	488	0.6

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

*Denotes score from 1995 (no 1999 score available).

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

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

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

NOTE: Parentheses indicate nations not meeting international sampling and/or other guidelines in the year for which data are reported. See appendix 2 for details for 1999. See NCES (1996) for details for 1995.
The international average is the average of the national averages of the 54 nations.
1995 scores are based on re-scaled data.
s.e. means standard error.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study–Repeat (TIMSS–R), unpubished tabulations, 1999.

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